BIDDING DOCUMENTS, CONTRACT DOCUMENTS, SRF CONDITIONS, STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

for the

GREEN RIVER – ROCK SPRINGS – SWEETWATER COUNTY JPWB CROSSROADS PUMP STATION

RELEASE FOR BID **February 2026**

SUNRISE ENGINEERING

BIDDING DOCUMENTS, CONTRACT DOCUMENTS, SRF REQUIREMENTS, STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

For the

GR-RS-SC JPWB CROSSROADS PUMP STATION PROJECT

Prepared By:

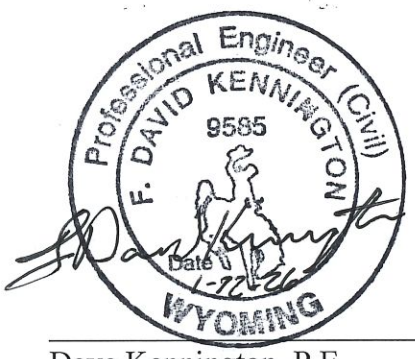
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State of Wyoming, No. 9585

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ADVERTISEMENT FOR BIDS

Green River – Rock Springs – Sweetwater County (GR-RS-SC) JOINT POWERS WATER BOARD
GREEN RIVER, WY
Crossroads Pump Station

General Notice

The GR-RS-SC Joint Powers Water Board (Owner) is requesting Bids for the construction of the following Project:

Crossroads Pump Station

Bids for the construction of the Project will be received in printed (hard copy) only format until **5:00 P.M.** local time**, Friday, April 17, 2026** at **#3 Telephone Canyon Road, Green River, WY 82935 or P.O. Box 1299 Green River WY 82935**. The Bids received will be publicly opened and read aloud. All bids will be reviewed and tabulated by the Engineer and Owner. Once award can be recommended, the recommendation will be presented to the GR-RS-SC Joint Powers Water Board for possible action.

The Project includes the following Work:

Construction of a 30-inch welded steel suction pipeline, a pump station, and a 30-inch steel and PVC discharge pipeline. Overall, 14,600-ft of 30-inch pipe will be installed.

Obtaining the Bidding Documents

Information and Bidding Documents for the Project can be found at the following designated website:

https://planroom.sunrise-eng.com

Bidding Documents may be downloaded from the designated website after March 5, 2026. Prospective Bidders are urged to register with the designated website as a plan holder, even if Bidding Documents are obtained from a plan room or source other than the designated website in either electronic or paper format. The designated website will be updated periodically with addenda, lists of registered plan holders, reports, and other information relevant to submitting a Bid for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through the designated website. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the designated website.

Pre-bid Conference

A mandatory pre-bid conference for the Project will be held on **Thursday, March 19, 2026** at **1:30 PM** at **City of Rock Springs Downstairs Conference Room 212 D Street, Rock Springs, WY 82901.** Attendance at the pre-bid conference is required.

Instructions to Bidders.

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents.

American Iron and Steel

Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. The Infrastructure Investment and Jobs Act made the AIS provision permanent for DWSRF

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projects. All iron and steel products used in the project shall be produced in the United States, unless a waiver is provided by the United States Environmental Protection Agency (EPA). The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

Disadvantaged Business Enterprises

Qualified Disadvantaged Business Enterprises (DBEs) are encouraged to submit bids on this project. Bidders that use a subcontractor(s)/supplier(s) are required to make good faith effort at soliciting DBE subcontractor/supplier participation. Bidders shall submit the required DBE Good Faith Effort Documentation form and other related forms with their bid.

In-State Preference

In accordance with W.S. 16-6-106 preference is hereby given to materials, supplies, agricultural products, equipment, machinery and provisions produced, manufactured or grown in Wyoming, or supplied by a resident of the state, quality being equal to articles offered by the competitors outside of the state.

In accordance with W.S. 16-6-102 preference is given to resident contractors.

Contractor receiving the project may designate an interest-bearing account for retainage in accordance with W.S. 16-6-702, 704, and 705.

Project is funded in part by the State Revolving Loan Fund, the Wyoming Water Development Commission and the City of Rock Springs.

Contract Securities

In accordance with W.S. 15-1-113(d) & (f) W.S.16-6-112 the successful bidder will provide contract security in an amount equal to 100% of contract price.

Davis Bacon Act

The Davis Bacon Act and associated 29 CFR 5.5 applies to this project.

This Advertisement is issued by:

Owner: **GR-RS-SC Joint Powers Water Board**
By: **Bryan Seppie, P.E.**
Title: **Project Manager**
Date: **February 26, 2026**

Advertisement Dates: March 5th and 12th 2026

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INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office*—The office from which the Bidding Documents are to be issued, and which registers plan holders.

ARTICLE 2—BIDDING DOCUMENTS

2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.

2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Owner recommends that Bidder register as a plan holder with the Issuing Office at such website, and obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.

2.04 Plan rooms (including construction information subscription services, and electronic and virtual plan rooms) may distribute the Bidding Documents, or make them available for examination. Those prospective bidders that obtain an electronic (digital) copy of the Bidding Documents from a plan room are encouraged to register as plan holders from the Bidding Documents Website or Issuing Office. Owner is not responsible for omissions in Bidding Documents or other documents obtained from plan rooms, or for a Bidder's failure to obtain Addenda from a plan room.

2.05 *Electronic Documents*

A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.

1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat 2020 or later. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not

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guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.05.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 Bidder is to submit the following information with its Bid to demonstrate Bidder's qualifications to perform the Work:

A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.

B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.

C. Bidder's state or other contractor license number, if applicable.

D. Subcontractor and Supplier qualification information.

E. Other required information regarding qualifications.

3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

ARTICLE 4—PRE-BID CONFERENCE

4.01 A mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Proposals will not be accepted from Bidders who do not attend the conference. It is each Bidder's responsibility to sign in at the pre-bid conference to verify its participation. Bidders must sign in using the name of the organization that will be submitting a Bid. A list of attendees that attended the pre-bid conference and are eligible to submit a Bid for this Project will be issued in an Addendum.

4.02 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions

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at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

5.02 *Existing Site Conditions*

A. *Subsurface and Physical Conditions; Hazardous Environmental Conditions*

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:

a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.

b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

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5.03 *Other Site-related Documents*

A. In addition to the documents regarding existing Site conditions referred to in Paragraph 5.02.A, the following other documents relating to conditions at or adjacent to the Site are known to Owner and made available to Bidders for reference:

1. Geotechnical Investigation Report, Western EGI, 3-18-24
2. BLM ROW WYW105843389_30 inch water pipeline
3. BLM ROW WYW106349935_Temp Work Area
4. Paleontological Survey Report, Stratigraphic rex LLC, 7-21-23
5. Class III Cultural Resource Inventory Report, Western Archaeological Services, 8-2-23 (redacted)

Owner will make copies of these other Site-related documents available to any Bidder on request.

B. Owner has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.

C. The other Site-related documents are not part of the Contract Documents.

D. Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.

E. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.

B. A Site visit is scheduled for **Thursday, March 19, 2026,** following the conclusion of the pre-bid conference. Maps to the Site will be made available upon request.

C. Bidders visiting the Site are required to arrange their own transportation to the Site.

D. All site visits must be conducted during normal working hours.

E. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

F. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.

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G. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

H. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 *Owner's Safety Program*

A. Site visits and work at the Site may be governed by an Owner safety program. If an Owner safety program exists, it will be noted in the Supplementary Conditions.

5.06 *Other Work at the Site*

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Express Representations and Certifications in Bid Form, Agreement*

A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:

A. **Question shall be submitted in writing via email to dkennington@sunrise-eng.com.**

7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven (7) days prior to the date for opening of Bids may not be answered.

7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract

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Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of **five (5)** percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 30 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment are set forth in the Agreement.

9.02 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those "or-equal" or substitute or materials and equipment approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an "or-equal" or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer before the date of the pre-bid meeting. Each such request must comply with the requirements of Paragraphs 7.05 and 7.06 of the General Conditions, and the review of the request will be governed by the principles in those paragraphs. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an

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Addendum issued to all registered plan holders. Bidders cannot rely upon approvals made in any other manner.

10.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.01 A Bidder must be prepared to retain specific Subcontractors and Suppliers for the performance of the Work if required to do so by the Bidding Documents or in the Specifications. If a prospective Bidder objects to retaining any such Subcontractor or Supplier and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.

11.02 The bidder, must submit to Owner a list of the Subcontractors or Suppliers proposed for the Work with the bid. For this project bid the following list of Subcontractors or Suppliers are required:

1. Boring Sub-Contractor
2. Steel Pipe Supplier
3. Welding Sub-Contractor
4. Cathodic Protection Sub-Contractor
5. Pump Station Electrical Sub-Contractor
6. Pump Supplier

The bid shall include EJCDC Form C451, Schedule B, for these Subcontractor or Suppliers.

11.03 As requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

11.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for return of the Bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

ARTICLE 12—PREPARATION OF BID

12.01 Bids for the construction of the Project will be received in printed (hard copy) only format submitted to the location identified in the Advertisement for Bids. Bid shall be marked "Bid Enclosed" clearly on the outside of the envelope. If delivered via Fed Ex, UPS, or other outside envelope, the marked bid envelope shall be contained inside the delivery envelope.

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12.02 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.

12.03 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

12.04 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

12.05 A Bid by an individual must show the Bidder's name and official address.

12.06 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

12.07 All names must be printed in ink below the signatures.

12.08 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

12.09 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.

12.10 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

12.11 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

12.12 In addition to the bid and bid bond, all bids shall include the following:

A. "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion" -- Lower Tier Covered Transactions (Pg 1-2 of SRF Special Conditions)

B. "Certification Regarding Lobbying" – EPA Form 6600-06 (Pg 3 of SRF Special Conditions)

C. "DBE Good Faith Effort Documentation" form (Pg 45 of SRF Special Conditions)

D. "Bidders List" (listing all entities, DBE or not, that submitted a quote to Bidder; see form) (Pg 47 of SRF Special Conditions)

E. EPA Form 6100–3—"DBE Program Subcontractor Performance Form(s)" (if using any DBEs) (Pg 51 of SRF Special Conditions)

F. EPA Form 6100–4—"DBE Program Subcontractor Utilization Form" (if using any DBEs) (Pg 53 of SRF Special Conditions)

G. Copy of Certificate of Residency, if bidding as a resident

H. Qualifications (See 3.01)

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I. List of subcontractors or suppliers (see Section 11.02) with EJCDC Form C451 Schedule B.

ARTICLE 13—BASIS OF BID

13.01 *Lump Sum*

A. Bidders must submit a Bid on a lump sum basis for certain items as set forth in the Bid Form.

13.02 *Unit Price*

A. Bidders must submit a Bid on a unit price basis for each item of Work listed as a unit price on the Bid Form.

B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity", which Owner or its representative has set forth in the Bid Form, for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

D. Upon project closeout all, unit quantities will be adjusted to the final installed quantities as measured and/or counted in the field. A final, balancing change order will be prepared to make the adjustment.

ARTICLE 14—SUBMITTAL OF BID

14.01 All bids and accompanying documentation must be submitted in printed hard copy format , on or before the day and hour set forth in the Advertisement to Bid. Bids will not be accepted after that time.

14.02 Any bids submitted in any form other than hard copy will not be accepted.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

15.01 An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.

15.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, the Bidder may withdraw its Bid,

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and the Bid security will be returned. Thereafter, if the Work is rebid, the Bidder will be disqualified from further bidding on the Work.

ARTICLE 16—OPENING OF BIDS

16.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

17.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

18.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.

18.05 *Evaluation of Bids*

A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

B. For determination of the apparent low Bidder, Bids will be compared on the basis of the total bid including the pump station line item carried forward from the schedule of values.

C. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.

18.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for

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those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

18.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

18.08 Preference is given to resident contractors in accordance with State Statute 16-6-102. The contract shall be let to the responsible certified resident making the lowest bid, if the certified resident's bid is not more than five percent (5%) higher than that of the lowest responsible nonresident bidder and the resident bidder does not propose to subcontract more than thirty percent (30%) of the work to nonresident contractors. A resident for this purpose must be certified as a resident by the Wyoming Department of Workforce Services prior to bidding upon the contract. See W.S. 16-0-101, et seq. A resident bidder shall submit a copy of its certificate of residency with its bid.

18.09 Contractor must employ Wyoming laborers on this project in accordance with W.S. 16-6-203 unless the local Workforce Center certifies that qualified Wyoming labor is unavailable.

18.10 Preference is hereby given to materials, supplies, agricultural products, equipment, machinery and provisions produced, manufactured or grown in Wyoming, or supplied by a resident of the state, quality being equal to articles offered by the competitors outside of the state in accordance with W.S. 16-6-104, W.S. 16-6-105, W.S. 16-6-106, and W.S. 16-6-107.

ARTICLE 19—BONDS AND INSURANCE

19.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by required bonds and insurance documentation.

19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20—SIGNING OF AGREEMENT

20.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 30 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful

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Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 21—SALES AND USE TAXES

21.01 Project is not exempt from Wyoming state sales and use taxes on materials and equipment to be incorporated in the Work. Said taxes must be included in the Bid. Refer to Paragraph SC-7.10 of the Supplementary Conditions for additional information.

ARTICLE 22—BIDDER INSTRUCTIONS

22.01 Plans and specifications have been prepared by Sunrise Engineering and will be available after March 5th, 2026 on their website plan room at http://www.sunrise-eng.com. Click on "Plan Room" at the top right corner of the homepage. Bidders must register, sign-in, and choose the specific project to become a plan holder to obtain access to CONTRACT DOCUMENTS, SPECIFICATIONS and PLANS.

22.02 Notices regarding changes/amendments to the CONTRACT DOCUMENTS, SPECIFICATIONS and PLANS will be sent to the e-mail address associated with the bidder's registration. Bidders are responsible to maintain current and correct contact information and checking the plan room often to receive updates or additional documents/changes/amendments. The ENGINEER for this Contract will be Sunrise Engineering and they will be represented by David Kennington, P.E. as Project Engineer.

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BID FORM FOR CONSTRUCTION CONTRACT

The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to: **Green River-Rock Springs-Sweetwater County Joint Powers Water Board**

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2—ATTACHMENTS TO THIS BID

2.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security;

B. Information Required of Bidder;

C. List of Subcontractors and Suppliers (EJCDC Form 451, Schedule B);

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;

E. Certificate of residency if claiming resident status.

F. SRF Documents

1. Signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – Lower Tier Coverd Transactions.
2. Signed Certification Regarding Lobbying (EPA Form 6600-06)
3. DBE Good Faith Effort Documentation & Other DBE Documents (as necessary) including the following:
    - Completed and signed DEB Good Faith Effort Documentation (Even if no outside subcontractors or suppliers will be used.)
    - Completed and Signed Disadvantaged Business Enterprise (DBE) Program DBE Subcontractor Performance Form (EPA Form 6100-3) if any DBEs will be utilized.
    - Completed and Signed Disadvantaged Business Enterprise (DBE) Program DBE Subcontractor Utilization Form (EPA form 6100-4) if any DBEs will be utilized.
4. Bidder's List

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ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

3.01 *Unit Price Bids*

Bidder will perform the following Work at the indicated unit prices:

Bidder acknowledges that:

1. Each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and

2. Estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

No.	Meas. & Pmt. Reference	Item	Quantity	Unit	Unit Price	Amount
1	02000	Mobilization	1	L.S.		
2	02510	Materials Sampling and Testing	1	L.S.		
3	02005	Traffic Control	1	L.S.		
4	02015	Clear and Grub	1	L.S.		
5	SP02200	Weak Soils Crossing	700	L.F.		
6	SP02200	Solid Rock Excavation	7,200	C.Y.		
7	02208	Flowable Backfill	100	L.F.		
8	02200	Imported Pipe Bedding	14,750	L.F.		
9	02315	Boring and Jacking 48" Casing (I-80)	310	L.F.		
10	02315	Boring and Jacking 48" Casing (Foothill and Sunset)	80	L.F.		
11	SP15110	30" ID Poly Coated CM lined Steel Pipe 0.25 Wall 36 ksi	5,940	L.F.		
12	SP15110	30" Pipe Installation, Grouting, and Poly Wrap Joints	5,940	L.F.		
13	SP15110	Fabricated Steel Bends	34	E.A.		
14	SP15110	Fabricated Steel Tee 30x12	4	E.A.		
15	02222	30" PVC DR 25 Class 165 AWWA C-900	8,735	L.F.		
16	15230	30" MJ Butterfly Valve (Direct Bury)	6	EA.		
17	15230	18" MJ Butterfly Valve (Direct Bury)	4	EA.		
18	15230	18" Swing Check Valve (Includes Vault & Tie-in to Existing 18")	1	EA.		
19	15230	12" Gate Valve	6	EA.		

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20	SP02222	Manway - Det. A/D10 and Det. A/D12	1	EA.		
21	SP02222	Manway with (1)Air/Vac - Det. C/D11	4	EA.		
22	SP02222	Manway with (2)Air/Vac - Det. A/D9	1	EA.		
23	SP02222	Connection to Existing Pipeline (20" AC Pipeline at STA 0+00)	1	L.S.		
24	SP02222	Connection to Existing Pipeline (30" x 18" Connection Near Tank Sta. 146+26)	1	L.S.		
25	SP02222	Blow Off Assembly	6	EA.		
26	SP02222	Air/Vac Assembly - Det. C/D10 and Det. C/D12	9	EA.		
27	15230	Fire Hydrant Assembly	2	EA.		
28	SP02222	Connection to Existing Pipeline (STA 29+40 & 31+49)	2	EA.		
29	02105	Untreated Base Course (WYDOT Gradation W)	200	C.Y.		
30	02500	Remove and Replace Existing Sign Post	4	EA.		
31	02500	Remove 15" Culvert	1	EA.		
32	02226	15" Culvert Pipe	100	L.F.		
33	02500	Field Fence Removal	100	L.F.		
34	02500	Field Fence Replacement	100	L.F.		
35	SP02795	Erosion Control Wattles	1	L.S.		
36	SP02795	Filter Fabric Fence	4,000	L.F.		
37	SP02795	Ephemeral Wash Crossing (Including Gabion Baskets)	350	L.F.		
38	02900	Field Seeding	10	Acre		
39	SP02222	Fiberglass Marker Post	15	E.A.		
40	SP02222	Waterline Sign Post	15	E.A.		
41	02206	Access Road (To Pump Station)	670	L.F.		
42	02000	Project Sign	2	Each		
43	01000	Pre-Construction DVD (or digital type recording)	1	L.S.		
					Subtotal	
44		Pump Station	1	L.S.		
					TOTAL	

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ARTICLE 4—TIME OF COMPLETION

4.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

4.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 5—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

5.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for 40 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

5.02 *Instructions to Bidders*

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Bidder's Representations*

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work**, including all American Iron and Steel requirements.**
4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost,

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progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.
2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.
3. Bidder has not solicited or induced any individual or entity to refrain from bidding.
4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:
    a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.
    b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.
    c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.
    d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

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Modified to include RD edits from RUS Bulletin 1780-26 (6/16/2020).

BIDDER hereby submits this Bid as set forth above:

Bidder:

_____

(typed or printed name of organization)

By: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's Contractor License No.: (if applicable) _____

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BID BOND (PENAL SUM FORM)

Bidder	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Bid**
Name: **GR-RS-SC Joint Powers Water Board**	Project:
Address *(principal place of business)*:	**Crossroads Pump Station**
3 Telephone Canyon Road **P.O. Box 1299** **Green River, WY 82935**	Bid Due Date: **Friday, April 17, 2026**
Bond	
Penal Sum:	
Date of Bond:	

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

Bidder	Surety
_____	_____
(Full formal name of Bidder)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature) (Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title:	Title:

Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.

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1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
    3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
    3.2. All Bids are rejected by Owner, or
    3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

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ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

1.02 Provide information on the Business's organizational structure:

Form of Business:	☐ Sole Proprietorship ☐ Partnership ☐ Corporation		
☐ Limited Liability Company ☐ Joint Venture comprised of the following companies:			
	1.		
	2.		
	3.		
Provide a separate Qualification Statement for each Joint Venturer.			
Date Business was formed:		State in which Business was formed:	
Is this Business authorized to operate in the Project location?		☐ Yes ☐ No ☐ Pending	

1.03 Identify all businesses that own Business in whole or in part (25% or greater), or that are wholly or partly (25% or greater) owned by Business:

Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			

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1.04 Provide information regarding the Business's officers, partners, and limits of authority.

Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business:

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

3.01 Provide information regarding Business's Diverse Business Certification, if any. Provide evidence of current certification.

Certification	Certifying Agency	Certification Date
☐ Disadvantaged Business Enterprise		
☐ Minority Business Enterprise		
☐ Woman-Owned Business Enterprise		
☐ Small Business Enterprise		
☐ Disabled Business Enterprise		
☐ Veteran-Owned Business Enterprise		
☐ Service-Disabled Veteran-Owned Business		
☐ HUBZone Business (Historically Underutilized) Business		
☐ Other		
☐ None		

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ARTICLE 4—SAFETY

4.01 Provide information regarding Business's safety organization and safety performance.

Name of Business's Safety Officer:		
Safety Certifications		
Certification Name	Issuing Agency	Expiration

4.02 Provide Worker's Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 5—FINANCIAL

5.01 Provide information regarding the Business's financial stability. Provide the most recent audited financial statement, and if such audited financial statement is not current, also provide the most current financial statement.

Financial Institution:		
Business address:		
Date of Business's most recent financial statement:		☐ Attached
Date of Business's most recent audited financial statement:		☐ Attached
Financial indicators from the most recent financial statement		
Contractor's Current Ratio (Current Assets ÷ Current Liabilities)		
Contractor's Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)		

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ARTICLE 6—SURETY INFORMATION

6.01 Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

Surety Name:			
Surety is a corporation organized and existing under the laws of the state of:			
Is surety authorized to provide surety bonds in the Project location?	☐ Yes ☐ No		
Is surety listed in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury? ☐ Yes ☐ No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 7—INSURANCE

7.01 Provide information regarding Business's insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):			
Insurance Provider		Type of Policy (Coverage Provided)	
Are providers licensed or authorized to issue policies in the Project location?		☐ Yes ☐ No	
Does provider have an A.M. Best Rating of A-VII or better?		☐ Yes ☐ No	
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

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ARTICLE 8—CONSTRUCTION EXPERIENCE

8.01 Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

8.02 Provide information regarding the Business's previous contracting experience.

Years of experience with projects like the proposed project:				
As a general contractor:		As a joint venturer:		
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:				
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been barred from contracting by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been released from a bid in the past 5 years? ☐ Yes ☐ No				
Defaulted on a project or failed to complete any contract awarded to it? ☐ Yes ☐ No				
Refused to construct or refused to provide materials defined in the contract documents or in a change order? ☐ Yes ☐ No				
Been a party to any currently pending litigation or arbitration? ☐ Yes ☐ No				
Provide full details in a separate attachment if the response to any of these questions is Yes.				

8.03 List all projects currently under contract in Schedule A and provide indicated information.

8.04 List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business's experience with projects similar in type and cost of construction.

8.05 In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business's key leaders as well.

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.

B. Diverse Business Certifications if required by Paragraph 3.01.

C. Certification of Business's safety performance if required by Paragraph 4.02.

D. Financial statements as required by Paragraph 5.01.

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E. Attachments providing additional information as required by Paragraph 8.02.

F. Schedule A (Current Projects) as required by Paragraph 8.03.

G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.

H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.

I. Additional items as pertinent.

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This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

(If Business is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

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Schedule A—Current Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent		Safety Manager	Quality Control Manager
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent		Safety Manager	Quality Control Manager
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent		Safety Manager	Quality Control Manager
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

EJCDC® C-451, Qualifications Statement—Schedule A—Current Projects.
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Schedule B—Previous Experience with Similar Projects

Name of Organization				
Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

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Schedule B—Previous Experience with Similar Projects

Name of Organization				
Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

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Schedule C—Key Individuals

Project Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Project Superintendent			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

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Safety Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Quality Control Manager			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

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CONTRACT DOCUMENTS

NOTICE OF AWARD

Date of Issuance:	[Notice of Award Date]		
Owner:	GR-RS-SC Joint Powers Water Board	Owner's Project No.:	
Engineer:	Sunrise Engineering	Engineer's Project No.:	S07265.000
Project:	Crossroads Pump Station		
Contract Name:	GR-RS-SC Joint Powers Water Board Crossroads Pump Station		
Bidder:	[Contractor Firm's Name]		
Bidder's Address:	[Contractor's Address]		

You are notified that Owner has accepted your Bid dated **Friday, April 17, 2026** for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

Construction of a 30-inch welded steel suction pipeline, a pump station, and a 30-inch steel and PVC discharge pipeline. Overall, 14,600-ft of 30-inch pipe will be installed.

The Contract Price of the awarded Contract is **[Total Bid Amount].** Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

One (1) electronic copy of the unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☒ Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 30 days of the date of receipt of this Notice of Award:

1. Deliver to Owner one (1) electronic counterpart of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract Securities per W.S. 15-1-113(d)&(f) and W.S. 16-6-112 (performance and payment bonds for 100% of Contract Price) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner:	**GR-RS-SC Joint Powers Water Board**
By *(signature)*:	
Name *(printed)*:	Bryan Seppie, P.E.
Title:	Project Manager

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AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between **Green River – Rock Springs – Sweetwater County Joint Powers Water Board** (**GR-RS-SC Joint Powers Water Board)** ("Owner") and **[Contractor Firm's Name]** ("Contractor").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: **Construction of a 30-inch welded steel suction pipeline, a pump station, and a 30-inch steel and PVC discharge pipeline. Overall, 14,600-ft of 30-inch pipe will be installed.**

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **Construction of a 30-inch welded steel suction pipeline, a pump station, and a 30-inch steel and PVC discharge pipeline. Overall, 14,600-ft of 30-inch pipe will be installed.**

ARTICLE 3—ENGINEER

3.01 The Owner has retained **Sunrise Engineering** ("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by Engineer

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Days*

A. The Work will be substantially complete within **435** calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within **465** calendar days after the date when the Contract Times commence to run.

4.04 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also

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recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner **$3,000.00** for each calendar day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner **$1000.00** for each calendar day that expires after such time until the Work is completed and ready for final payment.

3. Liquidated damages for failing to timely attain Substantial Completion, and final completion are not additive, and will not be imposed concurrently.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

The second and subsequent applications for payment must be accompanied by Affidavit Acknowledging Payment to Materialmen, subcontractors and Laborers. See W.S. 16-6-1001(a)(iv).

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the 25th day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments

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previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. **95** percent of the value of the Work completed, pursuant to Wyoming Statute §16-6-702 (with the balance being retainage).

b. The Contractor may establish an interest bearing account for retainage in accordance with W.S. 16-6-702, -704, and -705.

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **100** percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **200** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions. Final payment cannot be made until the requirements of W.S. 16-6-116, 16-6-117, and 15-1-113(h) are met.

6.04 *Consent of Surety*

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.05 *Interest*

A. Pursuant to Wyoming Statute §16-6-602, the Owner shall pay interest beginning the forty-sixth day at the rate of one and one-half percent (1 ½%) per month on the unpaid balance of the progress payment until the account is paid in full, unless a good faith dispute exists as to Owner's obligation to pay all or a portion of the account.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds:
    a. Performance bond (together with power of attorney).
    b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions
5. Standard Construction Specifications
6. Drawings (not attached but incorporated by reference) consisting of **99** sheets with each sheet bearing the following general title: **GR-RS-SC Joint Powers Water Board Crossroads Pump Station**.

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7. Addenda numbers 1 to [0], inclusive.
8. Exhibits to this Agreement (enumerated as follows):
    a. Bid Schedule
9. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.
    d. Field Orders.
    e. Warranty Bond, if any.
10. SRF Special Conditions.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

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6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

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8.03 *Standard General Conditions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

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IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on **[Date of Agreement]** (which is the Effective Date of the Contract).

Owner:	Contractor:
GR-RS-SC Joint Powers Water Board *(typed or printed name of organization)*	[Contractor Firm's Name] *(typed or printed name of organization)*
By: _____ *(individual's signature)*	By: _____ *(individual's signature)*
Date: _____ *(date signed)*	Date: _____ *(date signed)*
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)* *(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*
Attest: _____ *(individual's signature)*	Attest: _____ *(individual's signature)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address for giving notices:	Address for giving notices:
Designated Representative:	Designated Representative:
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address:	Address:
Phone: _____	Phone: _____
Email: _____ *(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*	Email: _____ License No.: _____ *(where applicable)* State: _____

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NOTICE TO PROCEED

Owner:	GR-RS-SC Joint Powers Water Board	Owner's Project No.:	
Engineer:	Sunrise Engineering, LLC	Engineer's Project No.:	S07265.000
Contractor:	[Contractor Firm's Name]	Contractor's Project No.:	
Project:	Crossroads Pump Station		
Contract Name:			
Effective Date of Contract:	[Date of Agreement]		

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on **[Date for Notice to Proceed]** pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

The number of days to achieve Substantial Completion is **435** calendar days from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of **[Substantial Completion Date]**; and the number of days to achieve readiness for final payment is **465** calendar days from the commencement date of the Contract Times, resulting in a date for readiness for final payment of **[Date for Final Payment]**.

Owner:	**GR-RS-SC Joint Powers Water Board**
By *(signature)*:	
Name *(printed)*:	Bryan Seppie, P.E.
Title:	Project Manager
Date Issued:	[Date for Notice to Proceed]

Copy: Engineer

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PERFORMANCE BOND

Contractor Name: **[Contractor Firm's Name]** Address *(principal place of business)*:	**Surety** Name: Address *(principal place of business)*:
Owner Name: **GR-RS-SC Joint Powers Water Board** Mailing address *(principal place of business)*: **3 Telephone Canyon Road** **Green River, WY 82935**	**Contract** Description *(name and location)*: **Construction of a 30-inch welded steel suction pipeline, a pump station, and a 30-inch steel and PVC discharge pipeline. Overall, 14,600-ft of 30-inch pipe will be installed.** Contract Price: **[Total Bid Amount]** Effective Date of Contract: **[Date of Agreement]**

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:

    3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;

    3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

    3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

    5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

    5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

    5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

    5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

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5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

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statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows: None

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WARRANTY BOND

Contractor	**Surety**
Name: **[Contractor Firm's Name]** Address *(principal place of business)*:	Name: Address *(principal place of business)*:
Owner	**Construction Contract**
Name: **GR-RS-SC Joint Powers Water Board** Address *(principal place of business)*: **3 Telephone Canyon Road** **P.O. Box 1299** **Green River, WY 82935**	Description *(name and location)*: **Crossroads Pump Station** **Rock Springs Wyoming** Contract Price: **[Total Bid Amount]** Effective Date of Contract: **[Date of Agreement]** Contract's Date of Substantial Completion: **[Substantial Completion Date]**

Bond

Bond Amount: **$2,000,000**

Date of Bond: _____

Bond Period: Commencing at the date of Substantial Completion of the Work under the Construction Contract, and continuing until two years after such Substantial Completion.

Modifications to this Bond form:
☐ None ☐ See Paragraph 9

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth herein, do each cause this Warranty Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature) (Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

EJCDC® C-612, Warranty Bond.
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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract's Correction Period Obligations. The Construction Contract is incorporated herein by reference.

2. If the Contractor performs the Correction Period Obligations, the Surety and the Contractor shall have no obligation under this Warranty Bond.

3. If Owner gives written notice to Contractor and Surety during the Bond Period of Contractor's obligation under the Correction Period Obligations, and Contractor does not fulfill such obligation, then Surety shall be responsible for fulfillment of such Correction Period Obligations. Surety shall either fulfill the Correction Period Obligations itself, through its agents or contractors, or, in the alternative, Surety may waive the right to fulfill the Correction Period Obligations itself, and reimburse the Owner for all resulting costs incurred by Owner in performing Contractor's Correction Period Obligations, including but not limited to correction, removal, replacement, and repair costs.

4. The Surety's liability is limited to the amount of this Warranty Bond. Renewal or continuation of the Warranty Bond will not modify such amount, unless expressly agreed to by Surety in writing.

5. The Surety shall have no liability under this Warranty Bond for obligations of the Contractor that are unrelated to the Construction Contract. No right of action will accrue on this Warranty Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

6. Any proceeding, legal or equitable, under this Warranty Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located and must be instituted within two years after the Surety refuses or fails to perform its obligations under this Warranty Bond.

7. Written notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown in this Warranty Bond.

8. Definitions

    8.1. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page of this Warranty Bond, including all Contract Documents and changes made to the agreement and the Contract Documents.

    8.2. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

    8.3. *Correction Period Obligations*—The duties, responsibilities, commitments, and obligations of the Contractor with respect to correction or replacement of defective Work, as set forth in the Construction Contract's Correction Period clause, EJCDC® C-700, Standard General Conditions of the Construction Contract (2018), Paragraph 15.08, as duly modified.

    8.4. *Substantial Completion*—As defined in the Construction Contract.

    8.5. *Work*—As defined in the Construction Contract.

9. Modifications to this Bond are as follows: None

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PAYMENT BOND

Contractor	**Surety**
Name: **[Contractor Firm's Name]**	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **GR-RS-SC Joint Powers Water Board**	Description *(name and location)*: **Crossroads Pump Station Rock Springs Wyoming**
Mailing address *(principal place of business)*: **3 Telephone Canyon Road P.O. Box 1299 Green River, WY 82935**	Contract Price: **[Total Bid Amount]**
	Effective Date of Contract: **[Date of Agreement]**

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____	_____
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature)(Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond will arise after the following:

    5.1. Claimants who do not have a direct contract with the Contractor

        5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2. Pay or arrange for payment of any undisputed amounts.

    7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

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8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

    16.1. *Claim*—A written statement by the Claimant including at a minimum:

        16.1.1. The name of the Claimant;

        16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

        16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

        16.1.4. A brief description of the labor, materials, or equipment furnished;

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16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: None

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Affidavit Acknowledging Payment to Materialmen, Subcontractors and Laborers

[Completed form must accompany all requests for progress payments beginning with second request]

Contractor: _____

Owner: _____

Project: _____

[Before Owner may issue a progress payment, W.S. 16-6-1001(a)(iv) requires verification that all materialmen, subcontractors, and laborers have been paid for completed work through the date of the most recent previous progress payment. W.S. 16-6-1001(a)(iv) also requires that progress payments withheld by Contractor due to a reasonable dispute between Contractor and a materialman, subcontractor or laborer shall not be paid to Contractor but shall be retained in accordance with the guidelines addressing disputed final payment under the provisions of W.S. 16-6-117.]

I, _____, hereby certify to the best of my knowledge, information, and belief, and on penalty of false swearing, that:

- I am authorized to sign this affidavit on Contractor's behalf as Contractor's Representative.

- Other than the reasonable disputes listed and described in this affidavit, all materialmen, subcontractors, and laborers have been paid according to their respective contracts for the work or services they performed, or materials they provided for the above-referenced project through _____, 20____ (the date of the most recent previous progress payment).

- The funds for the disputes described in this affidavit are not included in the current progress payment request submitted with this affidavit, and are not included in the total amount claimed in that request as work completed.

Disputes: (If none, write "None." Attach additional pages as necessary.)

Name of Entity	Amount Not Paid	Reason Funds Not Paid
-		
-		

Total Amount Not Paid $_____

_____ _____

Signature of Contractor's Representative Date

_____

Name and Title of Contractor's Representative

STATE OF _____)
COUNTY OF _____)

The foregoing instrument was acknowledged before me by _____
this _____ day of _____, 20___.

Witness my hand and official seal.

_____

Notarial Officer

My commission expires: _____

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:	GR-RS-SC Joint Powers Water Board	Owner's Project No.:	
Engineer:	Sunrise Engineering, LLC	Engineer's Project No.:	S07265.000
Contractor:	[Contractor Firm's Name]	Contractor's Project No.:	
Project:	Crossroads Pump Station		
Contract Name:			

This ☐ Preliminary ☒ Final Certificate of Substantial Completion applies to:

☒ All Work ☐ The following specified portions of the Work:

Date of Substantial Completion: **TBD**

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner's Responsibilities: ☒ None ☐ As follows:

Amendments to Contractor's Responsibilities: ☒ None ☐ As follows:

The following documents are attached to and made a part of this Certificate:

Substantial Completion Punch List Items

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Engineer

By *(signature)*: _____

Name *(printed)*: David Kennington, P.E.

Title: Project Engineer

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NOTICE OF ACCEPTABILITY OF WORK

Owner:	GR-RS-SC Joint Powers Water Board	Owner's Project No.:	
Engineer:	Sunrise Engineering, LLC	Engineer's Project No.:	S07265.000
Contractor:	[Contractor Firm's Name]	Contractor's Project No.:	
Project:	Crossroads Pump Station		
Contract Name:			
Notice Date:	TBD	Effective Date of the Construction Contract:	[Date of Agreement]

The Engineer hereby gives notice to the Owner and Contractor that Engineer recommends final payment to Contractor, and that the Work furnished and performed by Contractor under the Construction Contract is acceptable, expressly subject to the provisions of the Construction Contract's Contract Documents ("Contract Documents") and of the Agreement between Owner and Engineer for Professional Services dated **February 3, 2020** ("Owner-Engineer Agreement"). This Notice of Acceptability of Work (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice has been prepared with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the Engineer's professional opinion.
3. This Notice has been prepared to the best of Engineer's knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor's Work) under the Owner-Engineer Agreement, and applies only to facts that are within Engineer's knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Owner-Engineer Agreement.
5. This Notice is not a guarantee or warranty of Contractor's performance under the Construction Contract, an acceptance of Work that is not in accordance with the Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Contract Documents, or to otherwise comply with the Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner's reservations of rights with respect to completion and final payment.

Engineer

By *(signature)*: _____

Name *(printed)*: David Kennington, P.E.

Title: Project Engineer

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WORK CHANGE DIRECTIVE NO. CoNum

Owner:	Owner	Owner's Project No.:	CoLPrNum
Engineer:	FrmName	Engineer's Project No.:	EnPrNum
Contractor:	ContFrmName	Contractor's Project No.:	
Project:	ProjName		
Contract Name:			
Date Issued:	DateIssue	Effective Date of Work Change Directive:	DateEff

Contractor is directed to proceed promptly with the following change(s):

Description:

CoDesc

Attachments:

[List documents related to the change to the Work]

Purpose for the Work Change Directive:

[Describe the purpose for the change to the Work]

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

Notes to User—Check one or both of the following

☐ Non-agreement on pricing of proposed change. ☐ Necessity to proceed for schedule or other reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price: $ WcDNewPrice **WcDiNoDeC**.

Contract Time: WcDNewTime days **WcDTimeInOrDe**.

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

	Recommended by Engineer	Authorized by Owner
By:		
Title:	Project Engineer	Project Manager
Date:	DateIssue	DateIssue

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CHANGE ORDER NO. CoNum

Owner:	GR-RS-SC Joint Powers Water Board	Owner's Project No.:	CoLPrNum
Engineer:	Sunrise Engineering	Engineer's Project No.:	EnPrNum
Contractor:	ContFrmName	Contractor's Project No.:	
Project:	Crossroads Pump Station		
Contract Name:			
Date Issued:	DateIssue	Effective Date of Change Order:	DateEff

The Contract is modified as follows upon execution of this Change Order:

Description:

CoDesc

Attachments:

[List documents related to the change]

Change in Contract Price	**Change in Contract Times [State Contract Times as either a specific date or a number of days]**
Original Contract Price: $ Original Contract Price	Original Contract Times: Substantial Completion: SubCompDate Ready for final payment: FpDate
Previous Change Orders: $ Total of Prev COs	Change in Contract Time Previous COs Substantial Completion: TimeDeltaPrior Ready for final payment: TimeDeltaPrior
Contract Price prior to this Change Order: $ Contract Total with Previous COs	Contract Times prior to this Change Order: Substantial Completion: ConSubTimePrior Ready for final payment: ConFpTimePrior
Total this Change Order: $ Current CO	Change in Contract Time this Change Order: Substantial Completion: TimeIncrease Ready for final payment: TimeIncrease
Contract Price incorporating this Change Order: $ Contract Total with all COs	Contract Times with all approved Change Orders: Substantial Completion: CoSubDate Ready for final payment: CoFpDate

	Recommended by Engineer (if required)	Accepted by Contractor
By:		
Title:	Project Engineer	
Date:	DateIssue	
	Authorized by Owner	Approved by Funding Agency (if applicable)
By:		
Title:	Project Manager	
Date:	DateIssue	

EJCDC® C-941, Change Order EJCDC® C-941, Change Order, Rev.1.
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FIELD ORDER NO.: [Number of Field Order]

Owner:	GR-RS-SC Joint Powers Water Board	Owner's Project No.:
Engineer:	Sunrise Engineering	Engineer's Project No.:
Contractor:		Contractor's Project No.:
Project:	Crossroads Pump Station0	
Contract Name:		
Date Issued:	Effective Date of Field Order:	

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s):

Drawing(s) / Details (s):

Description:

[Description of the change to the Work]

Attachments:

[List documents supporting change]

Issued by Engineer

By: _____

Title: _____

Date: _____

EJCDC® C-942, Field Order.
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Mark Gordon
Governor

WYOMING Department of Transportation

"Provide a safe and effective transportation system"

5300 Bishop Boulevard, Cheyenne, Wyoming 82009-3340

Darin J. Westby, P.E.
Director

To whom it may concern:

Attached is a packet of information that pertains to any entity proposing to place a utility facility within the Wyoming Department of Transportation (WYDOT) right of way or on WYDOT land in District 3 in township 18N , Wyoming.

UAR State Map.pdf This is a state map of Wyoming divided into the 5 WYDOT districts. The city names where the district offices are located are enclosed in a box. Contact the District License Technician in the district where the work is taking place.

Form M-54: This is the application for a license to place a facility within WYDOT rights-of-way .
It needs to be filled out in its entirety. The "Licensee" is the ultimate owner or entity who will take responsibility for the installation once construction is completed — not the contractor installing the facility. The M-54 must be signed by **an authorized representative of the Company**.

Form M-54A: District 3 Stipulations: This is a list of installation/construction criteria that will be required in Transportation District 3 in the State of Wyoming. Not all may apply to your application. It is a menu for us to pick from and we may add other stipulations for specific problems. When you receive this list attached to your approved license, it will be specific to your installation.

Form M-54B: This is a list of requirements specific to Fiber Optics Communications Facilities encroaching in WYDOT right of way.

Form M-54B-1: This is a list of requirements specific to Fiber Optics Communications Facilities encroaching in WYDOT Interstate right of way.

Form M-54C: This sheet gives the minimum requirements for Contractor Insurance

Examples: The following pages are **examples** of drawings that the Utility needs to submit along with the M-54. They identify the location of the installation in relation to various physical landmarks along the proposed route of installation - for instance, the distance off the right of way fence, or off the edge of the pavement

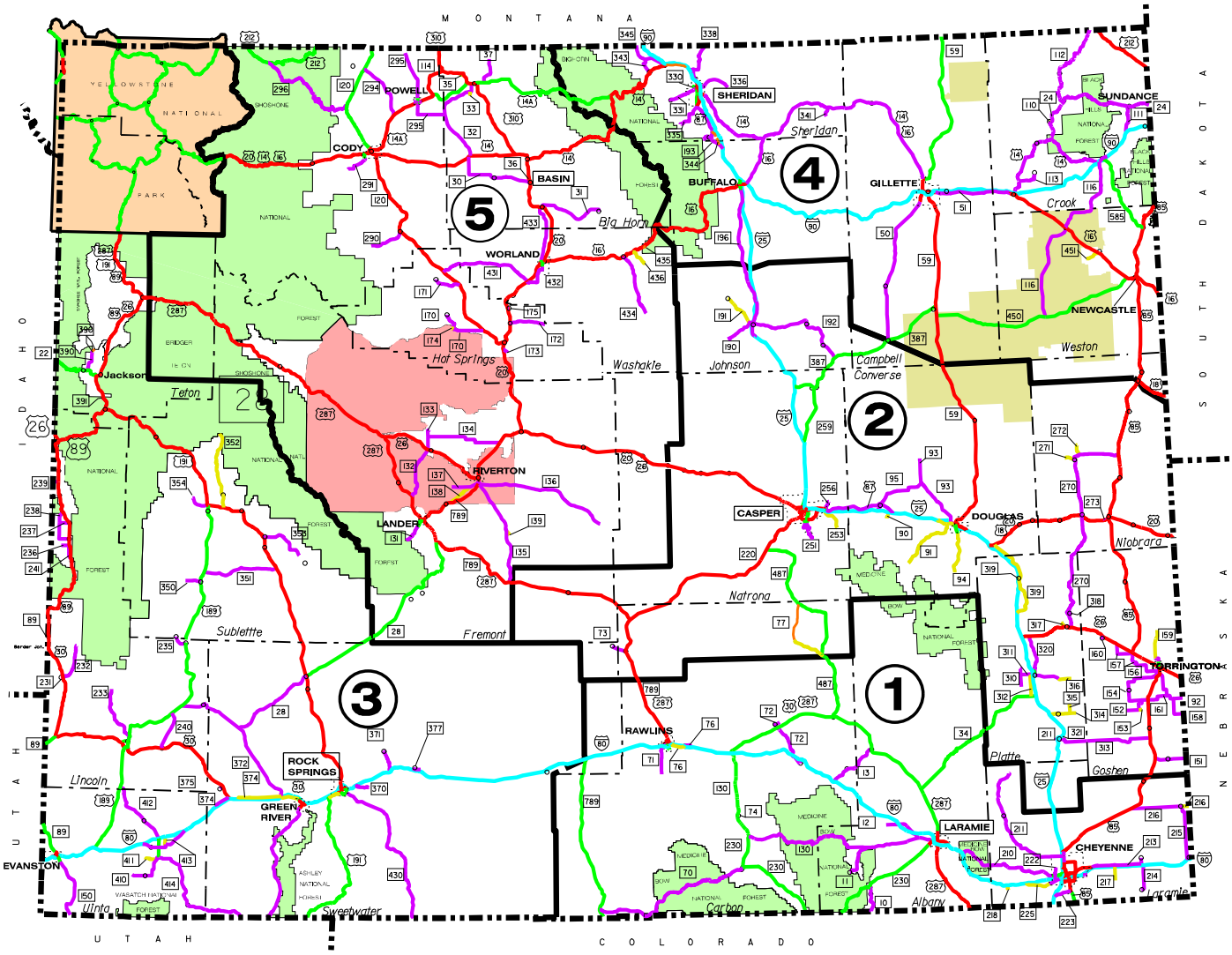
A ***WYDOT Utility License Packet*** and the ***WYDOT Utility Accommodation Regulations*** manual may be found at:
http://www.dot.state.wy.us/home/engineering_technical_programs/utilities_section.default.html

STATE OF WYOMING

PREPARED BY THE
WYOMING DEPARTMENT OF TRANSPORTATION

CONTACT THE DISTRICT MAINTENANCE ENGINEER
IN THE DISTRICT AREA WHERE THE WORK IS TAKING PLACE

DISTRICT NUMBER	PHYSICAL ADDRESS MAILING ADDRESS (IF DIFFERENT)	TELEPHONE NUMBER
1	3411 SOUTH 3RD STREET, LARAMIE, WY 82070	307 745-2117
2	900 BRYAN STOCK TRAIL, CASPER, WY 82601	307 473-3222
3	3200 ELK STREET, PO BOX 1260, ROCK SPRINGS, WY 82902-1260	307 352-3033
4	10 EAST BRUNDAGE LANE, SHERIDAN, WY 82801	307 674-2320
5	218 WEST C, PO BOX 461, BASIN, WY 82410	307 568-3413



TRANSPORTATION COMMISSION OF WYOMING and its WYOMING DEPARTMENT OF TRANSPORTATION

LICENSE

1. **Parties.** The parties to this License are GREEN RIVER ROCK SPRING SWEETWATER JPWB hereinafter referred to as Licensee, whose physical address is , Afton, Wy 83110 and the **TRANSPORTATION COMMISSION OF WYOMING and its WYOMING DEPARTMENT OF TRANSPORTATION**, whose address is 5300 Bishop Blvd, Cheyenne, WY 82009 - 3340, hereinafter referred to as Agency.

2. **Purpose of License.** The Licensee is planning the construction of the 30-inch Waterline Crossing in 48-inch Casing owned by the Green River-Rock Springs-Sweetwater County Joint Powers Water Board hereinafter referred to as Facility, located in:
Section(s) 5 Township 18N Range 105W County (ies) SWEETWATER
Company Tracking Number:

GPS Coordinates: SEE LOCATION DETAILS
GPS Datum NAD/83 accuracy to ±30' in decimal/degree format (e.g. Latitude 44.12345, Longitude -106.54321).
For encroachments, attach Form M-54G – *Additional GPS Coordinates* - included in the license packet.

FOR DISTRICT USE ONLY			
Maint. Section:		Dist. Ref. Number:	

FOR UTILITY SECTION USE ONLY					
Company Code:	GR-RS-JPWB	Folder:	LC-2025-00200	Direction:	
Offset:	Various	Encroach Type:	XING	Facility Type:	WATT

3. **Term of License and Required Approvals.** This License is effective when all parties have executed it and authority to proceed has been granted by the Agency.

4. **Responsibilities of Licensee.**

A. Condition of Approval. As a condition of approval for this License, the Licensee agrees to locate the Facility identified by this License at the Licensee's expense, in accordance with Wyoming Statute § 37 -1 2 - 301 et. seq. Wyoming Underground Facilities Notification Act. The Licensee also agrees to include the nature, location and depth of the Facility on an Engineering Drawing, using three dimensional planes and a datum reference determined by the Agency.
If unanticipated or unusual circumstances are encountered during Facility construction which forces a deviation in excess of two (2) feet from the approved horizontal alignment, the Licensee shall contact the respective district maintenance engineer and seek approval prior to making the deviation. The Licensee shall then file an amended exhibit.

B. Plan/Staking Sheet. The Licensee shall attach the Engineering Drawing, and a plan sheet and/or staking sheet showing the proposed facilities to be placed within the Agency's right-of-way, designated Exhibit "A", which is attached to and incorporated into this License by this reference. Upon completion of the proposed work, the Licensee shall submit to the Agency "As-Constructed" plans showing the actual location of the facilities within the Agency's right -of -way. Exhibit "A" and the "As-Constructed" plans shall comply with the *Wyoming Department of Transportation Utility Accommodation Regulation* and the following requirements:

(i) PLAN VIEW REQUIREMENTS

(a) Existing roadway, right-of-way line, right-of-way fence, and cross fences if they are not on the right-of-way line.

(b) Existing approaches, intersecting roads or streets, drainage ditches, irrigation ditches, pipes, and culverts that have to be crossed

(c) Existing major utility facilities.

(d) Proposed Facility alignment with offset distances from either the roadway centerline or right-of-way line.

(e) Location of existing facilities on the highway right-of-way that are owned and operated by the Company.

(f) Proposed locations of all support appurtenances such as air relief valves, manholes, pedestals, junction boxes, line marker, vent pipes, guys and anchors, etc.

(g) Size and/or capacity of the proposed Facility, that is, kV, number of cable pairs, pipe diameter, pipe type, wall thickness (for carrier and casing), product to be carried, max. operating psig, etc.

(h) Indicate with a highlighter, appropriate symbol, or verbiage (for example, "As-Constructed") the new Facility so that it is easily recognizable for someone reading the drawing(s).

(i) Legal description: Section, Township, and Range with North Arrow.

(j) Reference new Facility to the nearest milepost marker using a compass direction and footage. Example: "1231' east of milepost 30."

(k) All bridge attachments must be reviewed and approved by the WYDOT Bridge Program. Bridge attachments should indicate if the Facility is to be placed in an existing conduit or a new conduit on the bridge. Bridge attachments are addressed in the WYDOT Utility Accommodation Regulation.

(ii) AERIAL HIGHWAY CROSS SECTION

(a) Low sag design clearance above the high point of the roadway.

(b) Existing or proposed under-built facilities, including those by others.

(c) Cross section view of the highway right-of-way indicating the location of poles or support structures relative to the roadway centerline or right-of-way lines.

(iii) BURIED HIGHWAY CROSS SECTION

(a) Cross section view of the highway right-of-way at the crossing, showing the depth of the Facility relative to natural ground, roadway drainage ditch, and the roadway template.

(b) If casing pipe or conduit is used, indicate by dimension where the casing will end.

(c) If heavy wall thickness pipe is used instead of casing pipe, show where the heavy wall thickness pipe transitions back to normal thickness pipe.

The maximum sheet size shall be eleven inches by seventeen inches (11" x 17 "). Use of Agency supplied project plans and cross sections is recommended as most of the above requirements are met, saving time and expense to both parties. Contact the Agency for availability of paper plans and/or electronic design files.

C. Facility Placement. The Facility will be placed in a manner conforming to recognized s tandards, applicable federal, state, or local laws, codes, ordinances, and regulations; in the exact location shown on the attached "Exhibit A"; and as directed by the Agency. Placing the Facility in a location other than originally approved without obtaining prior Agency approval by submitting a revised "Exhibit A", will void the License.

D. Changes. Any future alterations, modifications, or removals (Adjustments) of the Facility within the highway right-of-way, required and requested by the Agency, shall be completed without delay. These Adjustments will be accomplished at no expense to the Agency, unless otherwise provided for by law. Any costs due to delays or lack of response to the Agency or an Agency contractor resulting from the failure of the Licensee to perform the required Adjustments necessitated by a highway construction project or maintenance activities, will be borne by the Licensee.

E. Limitations. This License will not be modified, transferred, or assigned without the written consent of the Agency. This License does not allow for installation of additional facilities, nor does this License set aside a strip of land of specific width for the exclusive use by the Licensee.

F. Cancellation or Nullification. The Licensee is required to notify the Agency in writing to cancel or nullify any issued License if the described Facility is not constructed within the prescribed time limits, scheduled to be removed, or taken out of service. No Facility will be allowed to be abandoned in place. The Facility must be removed at the time of abandonment.

G. Facility Access. The maintenance, use, inspection, and access to the Facility shall be accomplished from locations outside of the lines of no access or access control. Ingress or egress to and from the Facility from the traveled ways of an access controlled road is hereby expressly forbidden.

H. Traffic Control. The Licensee agrees to the standards for traffic control as outlined in the Agency's Traffic Control for Roadway Work Operations manual, which is incorporated into this License by this reference. Standards developed by the Licensee may be substituted for the cited manual provided they have been approved by the district traffic engineer. The Licensee must cease all operations if they do not comply with traffic control standards. Traffic control plans and road closure plans will be submitted to the Agency's engineer for approval prior to starting any work on highway right-of-way.

I. Contaminated Soil. Any Licensee installing a new Facility or replacing/upgrading an existing Facility that encounters any type of contaminated soil, will at the Licensee's expense manage the contaminated soil in accordance with current DEQ regulations.

5. Responsibilities of Agency. This License is issued pursuant to Wyoming Statute § 1-26-813, Right-of-Way Along Public Ways . . . , and grants permission for the Licensee to occupy a portion of the right-of-way controlled by the Agency. This permission is limited by the type of controlling interest held by the Agency. Responsibility to satisfy any other fee (deeded) interest rests with the Licensee.

6. General Provisions.

A. Additional Stipulations. Additional specific district stipulations may be attached to this form by the Agency as specified by the Wyoming Department of Transportation Utility Accommodation Regulation, which is incorporated into this License by this reference. The Licensee agrees to incorporate the applicable requirements into the design of the Facility and assures compliance with these requirements during the construction of the Facility. Non-compliance will void this License.

B. Ambiguities. The parties agree that any ambiguity in this License shall not be strictly construed, either against or for either party, except that any ambiguity as to sovereign immunity shall be construed in favor of sovereign immunity.

C. Amendments. Any changes, modifications, revisions or amendments to this License which are mutually agreed upon by the parties to this License shall be incorporated by written instrument, executed and signed by all parties to this License.

D. Applicable Law, Rules of Construction, and Venue. The construction, interpretation, and enforcement of this License shall be governed by the laws of the State of Wyoming, without regard to conflicts of law principles. The terms "hereof," "hereunder," "herein," and words of similar import, are intended to refer to this License as a whole and not to any particular provision or part. The Courts of the State of Wyoming shall have jurisdiction over this License and the parties. The venue shall be the First Judicial District, Laramie County, Wyoming.

E. Assignment Prohibited and License Shall Not be Used as Collateral. Neither party shall assign or otherwise transfer any of the rights or delegate any of the duties set out in this License without the prior written consent of the other party. The Licensee shall not use this License, or any portion thereof, for collateral for any financial obligation without the prior written permission of the Agency.

F. Award of Related Licenses. The Agency may award supplemental or successor Licenses or permits for work related to this License or may award contracts to other contractors for work related to this License. The Licensee shall cooperate fully with other contractors and the Agency in all such cases.

G. Construction Methods. The License is issued with the understanding that conventional construction methods like: trenching, plowing, boring, pole setting by truck, etc. will be used. Activities like blasting, erection of poles or structures by helicopter, and other non-conventional methods will require specific prior approval by the Agency's engineer.

H. Entirety of License. This Form M-54 License, consisting of five (5) pages; the attached Exhibits and Additional Stipulations, consisting of the pages stamped thereon; *the Wyoming Department of Transportation Utility Accommodation Regulations*; the Wyoming Department of Transportation's *Traffic Control for Roadway Work Operations* manual; and the "As Constructed" Plans, represent the entire and integrated License between the parties and supersede all prior negotiations, representations, and agreements, whether written or oral. In the event of a conflict or inconsistency between the language of this License and the language of any attachment, exhibit, or document incorporated by reference, the language of this License shall control.

I. Indemnification.

[For Private and Utility entities] The Licensee shall release, indemnify, and hold harmless the State, the Agency, and their officers, agents, and employees from any and all claims, suits, liabilities, court awards, damages, costs, attorneys' fees, and expenses arising out of Licensee's failure to perform any of Licensee's duties and obligations hereunder or in connection with the negligent performance of Licensee's duties or obligations, including, but not limited to, any claims, suits, liabilities, court awards, damages, costs, attorneys' fees, and expenses arising out of Licensee's negligence or other tortious conduct.

[For Municipality and Government entities] Each party to this Contract shall assume the risk of any liability arising from its own conduct. Neither party agrees to insure, defend, or indemnify the other.

J. Inspectors. Based upon the complexity, construction methods or other concerns, the Agency may assign part-time or full-time inspector(s) to the Licensee's project. The cost of such inspection will be at the sole expense of the Licensee, and the Agency's District Offices will initiate an *Authority for Rendering Special Services (ARS)*, as provided in *Operating Policy 24-3*.

K. Notices. All notices arising out of, or from, the provisions of this License shall be in writing and given to the parties at the address provided under this License, either by regular mail, facsimile, or delivery in person.

L. Proof of Insurance.

[For Private, Utility, and Governmental entities not covered by WARM or LGLP]The Licensee shall not commence work on this License until the Licensee has obtained all insurance required, provided a copy of all policies to the Agency, and such insurance has been approved by the Agency. Approval of the insurance shall not relieve or decrease the liability of the Licensee. The Licensee's insurance certificates shall be furnished or countersigned by a resident agent authorized to do business in the State of Wyoming.

Commercial General Liability Insurance. Commercial general liability insurance (CGL) coverage, occurrence form, covering liability claims for bodily injury and property damage arising out of premises, operations, products and completed operations, and personal and advertising injury, with minimum limits as follows:

(a) $1,000,000.00 each occurrence;

(b) $1,000,000.00 personal injury and advertising injury;

(c) $2,000,000.00 general aggregate; and

(d) $2,000,000.00 products and completed operations.

The CGL policy shall include coverage for Explosion, Collapse and Underground property damage. This coverage may not be excluded by endorsement.

[For Government entities that are self-insured] A letter/document documenting the limits of liability shall be attached.

[For Municipalities, the University of Wyoming, and other state or federal entities]
Licensee is protected by the Wyoming Governmental Claims Act, Wyo. Stat. § 1-39-101, *et seq*., and certifies that it is a member of the Wyoming Association of Risk Management (WARM) pool or the Local Government Liability Pool (LGLP), Wyo. Stat. § 1-42-201, *et seq*., and shall provide a letter verifying its participation in the WARM or LGLP to the Agency.

M. Sovereign Immunity.

[For Private and Utility entities] Pursuant to Wyo. Stat. § 1-39-104(a), the State of Wyoming and Agency expressly reserve sovereign immunity by entering into this License and specifically retain all immunities and defenses available to them as sovereigns. The parties acknowledge that the State of Wyoming has sovereign immunity and only the Wyoming Legislature has the power to waive sovereign immunity. Designations of venue, choice of law, enforcement actions, and similar provisions shall not be construed as a waiver of sovereign immunity. The parties agree that any ambiguity in this License shall not be strictly construed, either against or for either party, except that any ambiguity as to immunity shall be construed in favor of immunity.

[For Municipality and Government entities] Pursuant to Wyo. Stat. § 1-39-104(a), the State of Wyoming and Agency expressly reserve sovereign immunity by entering into this License and the Licensee expressly reserves governmental immunity. Each of them specifically retains all immunities and defenses available to them as sovereigns or governmental entities pursuant to Wyo. Stat. § 1-39-101, *et seq.*, and all other applicable law. The parties acknowledge that the State of Wyoming has sovereign immunity and only the Wyoming Legislature has the power to waive sovereign immunity. Designations of venue, choice of law, enforcement actions, and similar provisions shall not be construed as a waiver of sovereign immunity. The parties agree that any ambiguity in this License shall not be strictly construed, either against or for either party, except that any ambiguity as to immunity shall be construed in favor of immunity.

N. Third-Party Beneficiary Rights. The parties do not intend to create in any other individual or entity the status of third-party beneficiary, and this License shall not be construed so as to create such status. The rights, duties, and obligations contained in this License shall operate only between the parties to this License and shall inure solely to the benefit of the parties to this License. The provisions of this License are intended only to assist the parties in determining and performing their obligations under this License.

O. Titles Not Controlling. Titles of sections and subsections are for reference only and shall not be used to construe the language in this License.

P. Waiver. The waiver of any breach of any term or condition in this License shall not be deemed a waiver of any prior or subsequent breach. Failure to object to a breach shall not constitute a waiver.

Q. Work in Vicinity of Other Utilities. The Licensee is hereby advised that any work operation in the vicinity of electric power lines shall be in compliance with Wyoming Statute § 37-3-301 *et seq., Wyoming High Voltage Power Lines and Safety RestrictionsAct*, and the Licensee is further advised to comply with the provisions of Wyoming Statute § 37-12-301 *et.seq., Damage to Underground Public Utilities Facilities.*

7. **Signatures.** In witness thereof, the parties to this License, either personally or through their duly authorized representatives, have executed this License on the days and dates set out below, and certify that they have read, understood, and agreed to the terms and conditions of this License.

The effective date of this License is the date of the signature last affixed to this page.

Applicant

Dave Kennington,

Printed Name and Title



Signature

5/9/2025

Date

307-248-0160

Phone Number

Cell/Mobile Number

dkennington@sunrise-eng.com

Email

WYDOT Dist. Maint. Engineer - District 3

Tory Thomas, Dist. Maint. Engineer - District 3

Printed Name and Title



Signature

5/22/2025

Date

307-352-3033

Phone Number

307-352-3150

Cell/Mobile Number

tory.thomas@wyo.gov

Email

LOCATION DETAILS

Point #	Label	Latitude	Longitude	Main Line	R.M.	Offset	Maint. Sect.
WATT							
1	XING	41.56588	-109.28948	ML1918B	1.11	0	
2	XING	41.56673	-109.29001	ML80D	100.38	0	
3	XING	41.56723	-109.29035	ML1921B	1.33	0	

The following stipulations which have been checked are applicable to the attached license:

All Required Stipulations

Required. The Licensee/Contractor is required to provide standard Agency traffic control signing and flagmen at all times work is in progress within/on the right-of-way. Your attention is also directed to the Manual on Uniform Traffic Control Devices for Streets and highways (U.S. department of Transportation, Federal highway Administration) with which compliance is required.

Required. Traffic control devices must follow MUTCD standards. Reflective drums (barrels) must be used for lane taper and closures.

Required. Any Company or entity wishing to install utilities within WYDOT right-of-way or on WYDOT property will join the Locate Information Network prior to starting construction. Contact One-Call prior to digging.

Required. Perform all work in the WYDOT right-of-way in accordance with the 2021 edition of the WYDOT Spec. book, the current edition of the supplemental specifications, and standard plans. These can be found on the WYDOT website.

Required. You must notify the Area Maintenance Supervisor or the WYDOT inspector that has been assigned to this project, to advise them when you plan to begin actual operations that affect the highway right-of-way. You must also contact the Area Maintenance Supervisor or assigned inspector prior to demobilizing your equipment so that an inspection can be made to ascertain that the work was properly completed.

District Stipulations

Required. Subsequent Settlement of trenches, erosion of slopes, leakage of any ditches breached by this installation, or other problems which results in damage to the roadway and/or appurtenances or results in drainage problems on the right of way, are the responsibility of the licensee, and will be promptly and satisfactorily repaired upon notification by the AGENCY.

Required. Utility Company or their contractor personnel working within AGENCY rights-of-way must have a signed copy (paper or electronic) of the M-54 license permit, for the facility being installed, in their possession. This information must be furnished to any AGENCY personnel when requested. . Failure to meet this requirement will result in work being stopped and personnel and equipment being removed from the right-of-way.

Required. No materials or equipment will be stockpiled or parked (within the R/W) (within 30' of the traveled way).

Required. The Licensee/Contractor is required to provide standard Agency traffic control signing and flagmen at all times work is in progress within/on the right-of-way. Your attention is also directed to the Manual on Uniform Traffic Control Devices for Streets and Highways (U.S. Department of Transportation, Federal Highway Administration) with which compliance is required.

Required. Reseed in accordance with standard Agency specifications

Required. Traffic control devices must follow MUTCD standards. Reflective drums (barrels) must be used for lane taper and closers.

Ground Required Stipulations

Required. All disturbed areas will require reseeding. Seed will be drilled. The seed type and rate of distribution must be approved by AGENCY agronomist. All seed must be certified as weed free and certificates submitted to the district office. All seeded areas will be mulched with tackified straw or approved mulching material.

Required. Reseed in accordance with standard Agency specifications.

Mandatory Statewide Stipulations

Required. All personnel working within state highway right-of-ways will wear high-visibility safety apparel meeting Performance Class 3 specifications of the current ANSI/ISEA 107 standard.

Required. The minimum clearance over all state and federal highways shall exceed the NESC Code minimum by seven (7) feet at all locations for both crossings and encroachments. This minimum will be computed at maximum conductor or cable sag and shall also apply to underbuilt facilities.

Required. The minimum clearance for any conductor or cable within state and federal highway rights-of-way shall be 25’-6” computed at maximum conductor or cable sag to the highest point on the road, and shall also apply to underbuilt facilities

Required. A preconstruction conference will be scheduled with WYDOT Personnel Assigned prior to commencing work.

Required. Licensee is required to locate their facility, within five (5) business days, upon request from the Agency. The request may require the company to provide the Agency the nature, location, and depth of the Facility.

Required. All jogs in the alignment, manholes, hand holes, pull boxes or any other access to the underground utility must be delineated with an appropriate marker in the proper color. The installation route must also be marked at each entry/exit point of WYDOT's right-of-way, at changes of direction within the right-of-way, at 1000' intervals, at points of curvature and points of tangent.

Required. Utility Company and/or their contractor personnel working within WYDOT rights-of-way must have a signed copy (paper or electronic) of the M-54 license permit, for the facility being installed, in their possession. This information must be furnished to any WYDOT personnel when requested. . Failure to meet this requirement will result in work being stopped and personnel and equipment being removed from the right-of-way.

Required. Crossing of the roadway will be made by horizontal boring preferably from right-of-way to right-of-way but no less than feet from the toe of slope to the fence side. The use of Bentonite as a lubricant and backfill material is acceptable

Required. The diameter of the bore shall not exceed the casing diameter by more than five percent (5%).

Required. For 10" or less diameter pipe, the diameter of the bore shall not exceed 1.5 times the size of the finished pipe. For pipes larger than 10", the diameter of the bore shall not exceed the casing diameter by more than 5% unless required by equipment or product manufacturer specifications.

Required. The minimum depth for any buried power facility shall be 36". This includes conduits, when placed underneath or adjacent to the sidewalk.

Required. Any company or entity wishing to install utilities within WYDOT right-of-way or on WYDOT property will join the Locate Information Network prior to starting construction. Contact One-Call prior to digging.

Required. The appropriate City or County must be contacted for necessary permits.

Required. The maximum height of any pole installed in the right-of-way shall be no greater than the distance to the closest shoulder point on the road, or as directed by the Agency.

Required. Any infrastructure that requires recurring maintenance will be permitted in the right-of-way at the discretion of the Agency.

Required. If the proposed facility is to be installed within a current Sage-Grouse Core Area as depicted on the Wyoming Game and Fish website map, provide documentation demonstrating compliance with the current State of Wyoming Executive Order for Greater Sage-Grouse Core Area Protection. This documentation will include:
(1) Completing the density disturbance calculation tool analysis.
(2) Implementation of sage-grouse stipulations related to the utility facility; and
(3) Obtaining a sage-grouse executive order compliance letter from the Wyoming Game and Fish.

Required. Use the following link to determine Sage-Grouse/Big Game Migration areas:
https://wisdom.wygisc.org/Data/Sites/10/SPT/Index.html

Required. Impacts to any permitted off-road vehicle (ORV) trails in WYDOT right-of-way must be coordinated through the Wyoming State Trails Program (WSTP). WYDOT requires restoration of permitted ORV trails to original condition as directed by WSTP.

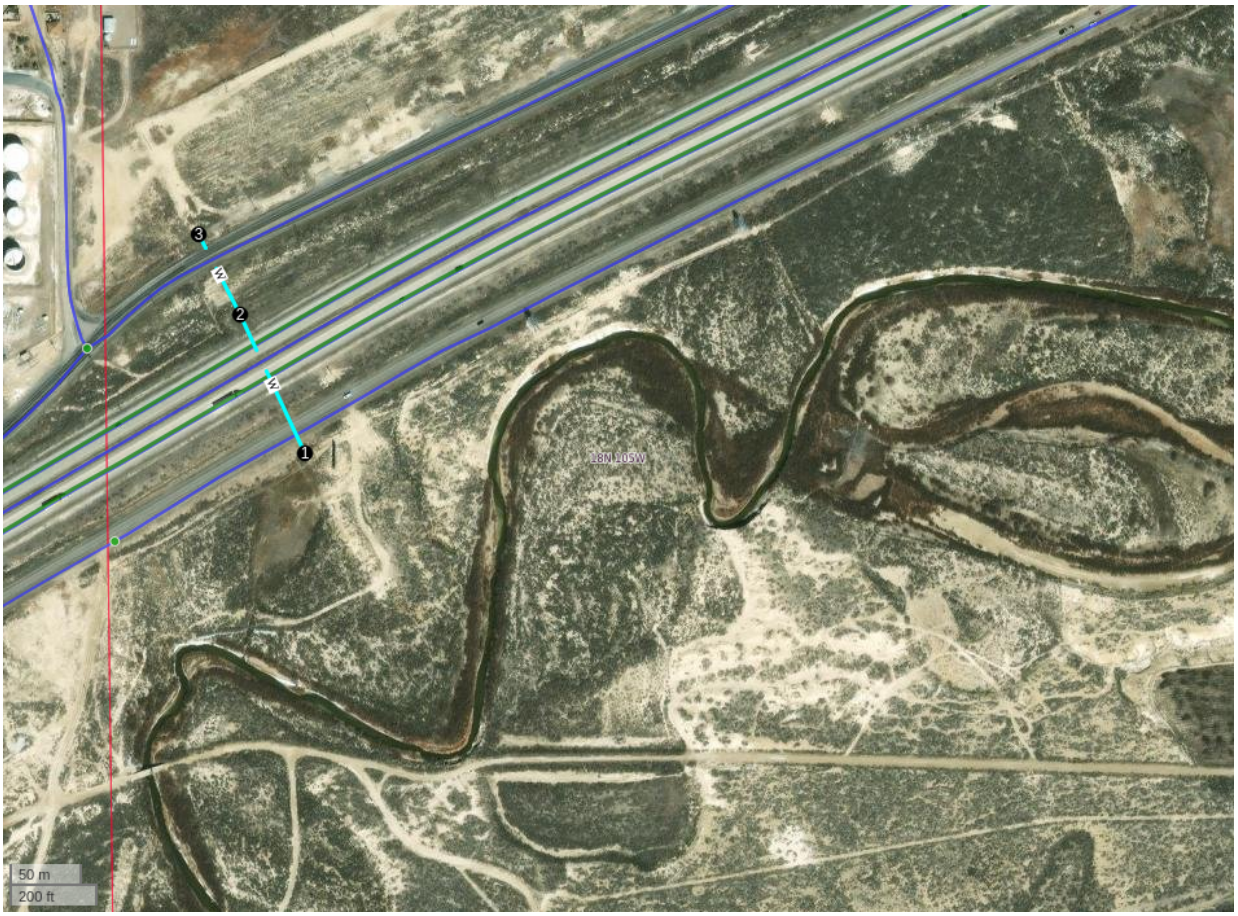
TRANSPORTATION COMMISSION OF WYOMING and its
WYOMING DEPARTMENT OF TRANSPORTATION

Additional GPS Coordinates

GPS Datum NAD/83 accuracy to ±30' in decimal/degree format (e.g. Latitude 44.12345, Longitude -106.54321). Supply GPS coordinates for each encroachment into/out of WYDOT's right-of-way or for each change in direction within the rightof-way.

You may disregard this form if your license exhibit contains this information.

#	Label	Latitude	Longitude	Mainline	R.M.	Offset
1	XING	41.56588	-109.28948	ML1918B	1.11	0.0
2	XING	41.56673	-109.29001	ML80D	100.38	0.0
3	XING	41.56723	-109.29035	ML1921B	1.33	0.0



United States Department of the Interior
BUREAU OF LAND MANAGEMENT
High Desert District - Rock Springs Field Office
280 Highway 191 North
Rock Springs, Wyoming 82901-3447
www.blm.gov/wy

In Reply Refer To:
2800 (WYD04)
WYWY105843389 (WYW190164)

DEC 20 2024

Byran Seppie P.E., General Manager
Joint Powers Water Board
P.O. Box 1299
Green River, Wyoming 82935

Re: 30-inch water pipeline

Dear Mr. Seppie:

Enclosed are two copies of right-of-way (R/W) grant offer on Bureau of Land Management (BLM) Form 2800-14, for your proposed water pipeline, BLM serial number WYWY105843389 (WYW190164). Please review the offer and if it meets with your approval, sign and date in the space provided, and return both copies to the address shown above. Upon receipt of the signed grant offer and the fees discussed below, the BLM will be able to issue the R/W grant absent any other unresolved issues.

The costs the BLM incurs while monitoring the construction and operation of your authorized use is assessed through the monitoring fee. This fee is categorized according to the number of work hours necessary to monitor the approved use and is not refundable. We anticipate your approved use will require a Monitoring Category 2, which involves a fee of $1,085.00. This fee must be paid prior to issuance of the grant.

Please return both signed copies of the grant, and the monitoring fee along with the attached Courtesy Statement to the address above. You are allowed 30 days from receipt of this offer in which to submit the required payments and the executed R/W grant. If these requirements are not met, the application may be denied.

This R/W grant, and the authority to use the lands described in the document, becomes effective on the date it is signed by an authorized officer of the BLM. A copy of the R/W grant will be returned to you when signed by the authorized officer.

If you have any questions, please contact Lisa Aleshire at 307-352-0377 or by email at laleshire@blm.gov.

Sincerely,

Kimberlee D. Foster
Field Manager

Attachments

FORM 2800-14
(August 1985)

Issuing Office
Rock Springs Field Office

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
RIGHT-OF-WAY GRANT

SERIAL NUMBER WYWY105843389 (WYW190164)

1. A right-of-way is hereby granted pursuant to Title V of the Federal Land Policy and Management Act of October 21, 1976 (90 Stat. 2776; 43 U.S.C. 1761).

2. Nature of Interest:

   a. By this instrument, the holder:

   Joint Powers Water Board
   P.O. Box 1299
   Green River, Wyoming 82935

   receives a right to construct, operate, maintain, and terminate a buried water pipeline, on public lands described as follows:

   Sixth Principal Meridian, Wyoming
   T. 18 N., R. 105 W.,
   sec. 6, SE1/4SE1/4;
   T. 19 N., R. 105 W.,
   sec. 32, lot 4.

   b. The right-of-way or permit area granted herein is 30 feet wide, 2,821 feet long and contains 1.94 acres, more or less.

   c. This instrument shall terminate on December 31, 2054, 30 years from its effective date unless, prior thereto, it is relinquished, abandoned, terminated, or modified pursuant to the terms and conditions of this instrument or of any applicable Federal law or regulation.

   d. This instrument may be renewed. If renewed, the right-of-way or permit shall be subject to the regulations existing at the time of the renewal and any other terms and conditions that the authorized officer deems necessary to protect the public interest.

   e. Notwithstanding the expiration of this instrument or any renewal thereof, early relinquishment, abandonment, or termination, the provisions of this instrument, to the extent applicable, shall continue in effect and shall be binding on the holder, its

successors, or assigns, until they have fully satisfied the obligations and/or liabilities accruing herein before or on account of the expiration, or prior termination, of the grant.

3. Rental

For and in consideration of the rights granted, the holder agrees to pay the Bureau of Land Management fair market value rental as determined by the authorized officer unless specifically exempted from such payment by regulation. Provided, however, that the rental may be adjusted by the authorized officer, whenever necessary, to reflect changes in the fair market rental value as determined by the application of sound business management principles, and so far as practicable and feasible, in accordance with comparable commercial practices.

4. Terms and Conditions:

a. This grant or permit is issued subject to the holder's compliance with all applicable regulations contained in Title 43 Code of Federal Regulations part 2800 and 2880.

b. Upon grant termination by the authorized officer, all improvements shall be removed from the public lands within 90 days, or otherwise disposed of as provided in paragraph (4)(d) or as directed by the authorized officer.

c. Each grant issued for a term of 20 years or more shall, at a minimum, be reviewed by the authorized officer at the end of the 20th year and at regular intervals thereafter not to exceed 10 years. Provided, however, that a right-of-way or permit granted herein may be reviewed at any time deemed necessary by the authorized officer.

d. The stipulations, plans, maps, or designs set forth in Exhibits A, B, C, D, and E, dated, May 9, 2023, attached hereto, are incorporated into and made a part of this grant instrument as fully and effectively as if they were set forth herein in their entirety.

e. Failure of the holder to comply with applicable law or any provision of this right-of-way grant or permit shall constitute grounds for suspension or termination thereof.

f. The holder shall perform all operations in a good and workmanlike manner so as to ensure protection of the environment and the health and safety of the public.

g. The holder shall contact the authorized officer at least FIVE days prior to the anticipated start of construction and/or any surface disturbing activities. The authorized officer may require and schedule a preconstruction conference with the holder prior to the holder's

commencing construction and/or surface disturbing activities on the right-of-way. The holder and/or his representative shall attend this conference. The holder's contractor, or agents involved with construction and/or any surface disturbing activities associated with the right-of-way, shall also attend this conference to review the stipulations of the grant including the plan(s) of development.

h. In the event that the public land underlying the right-of-way (ROW) encompassed in this grant, or a portion thereof, is conveyed out of Federal ownership and administration of the ROW or the land underlying the ROW is not being reserved to the United States in the patent/deed and/or the ROW is not within a ROW corridor being reserved to the United States in the patent/deed, the United States waives any right it has to administer the right-of-way, or portion thereof, within the conveyed land under Federal laws, statutes, and regulations, including the regulations at 43 CFR Part 2800, including any rights to have the holder apply to BLM for amendments, modifications, or assignments and for BLM to approve or recognize such amendments, modifications, or assignments. At the time of conveyance, the patentee/grantee, and their successors and assigns, shall succeed to the interests of the United States in all matters relating to the right-of-way, or portion thereof, within the conveyed land and shall be subject to applicable State and local government laws, statutes, and ordinances. After conveyance, any disputes concerning compliance with the use and the terms and conditions of the ROW shall be considered a civil matter between the patentee/grantee and the ROW Holder.

i. A bond, acceptable to the authorized officer, shall be furnished by the holder before execution of the grant or at such earlier date as may be specified by the authorized officer. The amount of this bond shall be determined by a Reclamation Cost Estimate submitted by the holder and approved by the authorized officer. This bond must be maintained in effect until removal of improvements and restoration of the R/W have been accepted by the authorized officer.

j. The holder agrees that all monies deposited with the authorized officer as security for holder's performance of the terms and conditions of this grant may, upon failure on the holder's part to fulfill any of the requirements herein set forth or made a part hereof, be retained by the United States to be applied as far as may be needed to satisfaction of the holder's obligations assumed hereunder, without prejudice whatever to any other rights and remedies of the United States.

k. Should the bond delivered under this grant become unsatisfactory to the authorized officer, the holder shall, within 30 days of demand, furnish a new bond.

l. Within 30 days of completion, the holder will submit to the authorized officer, as-built drawings and a certification of construction verifying that the facility has been constructed (and tested) in accordance with the design, plans, specifications, and applicable laws and regulations.

m. The United States, its officers and employees shall be held harmless from and indemnified against any damage, injury, or liability resulting from the construction, operation, or maintenance of the facility being authorized by this right-of-way grant, including but not limited to any liability which the United States may have as owner of the land which is the subject of the right-of-way grant.

n. Construction activity and surface disturbance will be prohibited during the period of November 15 through April 30 for the protection of big game crucial winter range. Any exceptions to this requirement must have prior written approval from the authorized officer.

o. Construction activity and surface disturbance will be prohibited during the period of February 1 through July 31 for the protection of raptors. Any exceptions to this requirement must have prior written approval from the authorized officer.

p. The holder shall construct, operate, and maintain the facilities, improvements, and structures within this right-of-way in strict conformity with the plan(s) of development which was (were) approved and made part of the grant on _____. Any relocation, additional construction, or use that is not in accord with the approved plan(s) of development, shall not be initiated without the prior written approval of the authorized officer. A copy of the complete right-of-way grant, including all stipulations and approved plan(s) of development, shall be made available on the right-of-way area during construction, operation, and termination to the authorized officer. Noncompliance with the above will be grounds for an immediate temporary suspension of activities if it constitutes a threat to public health and safety or the environment.

q. The holder shall designate a representative(s) who shall have the authority to act upon and to implement instructions from the authorized officer. The holder's representative shall be available for communication with the authorized officer within a reasonable time when construction or other surface disturbing activities are underway.

r. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the authorized officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer. An evaluation of the discovery will be made by the authorized officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the authorized officer after consulting with the holder.

s. A certified archeologist will be on site at all times during construction, where the pipeline crosses the Lincoln Highway. Any cultural materials located during construction will be reported to the authorized officer. Procedures for determining significance and/or effect will be established at that time. Cost of any further cultural work will be borne by the holder.

t. The holder shall recontour disturbed areas, or designated sections of the right-of-way, located in T. 18 N., R. 105 W., section 6, to preexisting conditions, by grading the site to approximately the original contour of the ground as determined by the authorized officer.

u. A certified paleontologist who meets or exceeds the qualification standards recommended by the Secretary of the Interior will inspect the open pipeline trench after construction and before the pipeline is placed into the trench. Any paleontological materials located during construction will be reported to the authorized officer. Procedures for determining the significance and/or effect will be established at that time. Cost of any further paleontological work will be borne by the holder.

v. Seed shall be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture shall be evenly and uniformly planted over the disturbed area (smaller/heavier seeds have a tendency to drop to the bottom of the drill and are planted first.) The holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed shall be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre noted below are to be doubled. The seeding will be repeated until a satisfactory stand is established as determined by the authorized officer. Evaluation of growth will not be made before completion of the first growing season after seeding. The authorized officer is to be notified a minimum of 5 working days prior to seeding of the project.

Seed Mixture B

Grasses – USE ALL	
Needle and thread grass	6 lbs/acre
Thickspike wheatgrass	6
Indian ricegrass	3
Bottlebrush squirreltail	2
Bluebunch wheatgrass	2
Shrubs - USE TWO	
Shadscale	1 lb/acre
Spiny hopsage	1

Forbs – USE TWO	
Northern sweetvetch	1/2 lb/acre
Rocky Mountain beeplant	1/2 lb/acre
Louisiana (prairie) sagebrush	1/2 lb/acre

Pure Live Seed (PLS) formula: % of purity of seed mixture times % germination of seed mixture = portion of seed mixture that is PLS

w. Use of pesticides shall comply with the applicable Federal and state laws. Pesticides shall be used only in accordance with their registered uses and within limitations imposed by the Secretary of the Interior. Prior to the use of pesticides, the holder shall obtain from the authorized officer written approval of a plan showing the type and quantity of material to be used, pest(s) to be controlled, method of application, location of storage and disposal of containers, and any other information deemed necessary by the authorized officer. Emergency use of pesticides shall be approved in writing by the authorized officer prior to such use.

x. The holder shall be responsible for weed control on disturbed areas within the limits of the right-of-way. The holder is responsible for consultation with the authorized officer and/or local authorities for acceptable weed control methods (within limits imposed in the grant stipulations).

y. The holder shall protect all survey monuments found within the right-of-way. Survey monuments include, but are not limited to, General Land Office and Bureau of Land Management Cadastral Survey Corners, reference corners, witness points, U.S. Coastal and Geodetic benchmarks and triangulation stations, military control monuments, and recognizable civil (both public and private) survey monuments. In the event of obliteration or disturbance of any of the above, the holder shall immediately report the incident, in writing, to the authorized office and the respective installing authority if known. Where General Land Office or Bureau of Land Management right-of-way monuments or references are obliterated during operations, the holder shall secure the services of a registered land surveyor or a Bureau cadastral surveyor to restore the disturbed monuments and reference using surveying procedures found in the Manual of Surveying Instructions for the Survey of the Public Lands in the United States, latest edition. The holder shall record such survey in the appropriate county and send a copy to the authorized officer. If the Bureau cadastral surveyors or other Federal surveyors are used to restore the disturbed survey monument, the holder shall by responsible for the survey cost.

z. No construction or routine maintenance activities shall be performed during periods when the soil is too wet to adequately support construction equipment or when watershed

damage is likely to occur. If such equipment creates ruts in excess of four inches deep, the soil shall be deemed too wet to adequately support construction equipment. Frozen soil or soil mixed with snow will not be used in construction.

aa. The holder shall meet Federal, State, and local emission standards for air quality.

bb. Construction-related traffic shall be restricted to routes approved by the authorized officer. New access roads or cross-country vehicle travel will not be permitted unless prior written approval is given by the authorized officer. Authorized roads used by the holder shall be rehabilitated or maintained when construction activities are complete as approved by the authorized officer.

cc. Except rights-of-way expressly authorizing a road after construction of the facility is completed, the holder shall not use the right-of-way as a road for purposes other than routine maintenance as determined necessary by the authorized officer in consultation with the holder.

dd. Prior to termination of the right-of-way, the holder shall contact the authorized officer to arrange a joint inspection of the right-of-way. This inspection will be held to agree to an acceptable termination (and rehabilitation) plan. This plan shall include, but is not limited to, removal of facilities, drainage structures, or surface material, recontouring, topsoiling, or seeding. The authorized officer must approve the plan in writing prior to the holder's commencement of any termination activities.

IN WITNESS WHEREOF, The undersigned agrees to the terms and conditions of this right-of-way grant or permit.

_____	_____
(Signature of Holder)	(Signature of Authorized Officer)
_____	_____ Field Manager _____
(Printed Name and Title)	(Title)
_____	_____
(Date)	(Effective Date of Grant)

EXHIBIT A" (Revised 4-27-23)

GREEN RIVER, ROCK SPRINGS, SWEETWATER COUNTY JOINT POWERS WATER BOARD

CONSTRUCTION, OPERATION AND MAINTENANCE PLAN

CULINARY WATER TRANSMISSION LINE AND PUMP STATION

Green River-Rock Springs-Sweetwater County Joint Powers Water Board applies for a Right-of-Way for a new treated drinking water transmission line.

1. PURPOSE and NEED FOR ROW FACILITY

a. What will be constructed

The Joint Powers Water Board (JPWB) plans to construct a 30" diameter PVC culinary water transmission line connecting on the south to the existing Green River-Rock Springs-Sweetwater County Joint Powers Water Board pipeline which lies on Union Pacific Right-of-Way property in the SE Quarter of Section 6, T18N, R105W. The transmission line will follow the route shown on the attached plan set. It will connect to a proposed pump station on private property located in the NW Quarter of Section 5, T18 N, R105W. From the pump station, the transmission line will continue north passing through Section 6, T18 N, R 105 W and Sections 29, 31 and 32 of T19N, R105W. The transmission line will connect with the existing Wind River Tank in the SW Quarter of Section 29, T19N, R105W.

A new 900-foot overhead power line will be installed to supply electricity to the proposed pump station.

See the attached Exhibit 4 for locations of the facilities.

b. Commodity to be transported and for what purpose

The pipeline and pump station will transport treated drinking water for the benefit of those living in the Green River, Rock Springs, Sweetwater County Joint Powers Water Board service territory.

c. Is the pipeline for a gathering system, trunk line, or distribution system

The pipeline would be considered a transmission line through BLM property.

d. Will it be surface or subsurface
Subsurface

e. Length and width of the right-of-way and the area needed for related facilities

The length of the waterline on BLM land for this project is 1,563 ft in Section 6 (T18N, R105W) and 1,258 ft in Section 32 (T19N, R105W) for a total of 2,821 ft. The permanent ROW width will be 30 ft making a total permanent ROW area of 1.94 acres. An additional 70 ft of temporary ROW is requested for construction with an area of 4.54 acres.

The pump station and support utilities will be located on private property.

f. Is this ancillary to an existing right-of-way

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No

g. List alternative routes or locations

The proposed pipeline route has been selected by the Joint Powers Water Board. Multiple routes were investigated during the WWDC Study which was conducted in 2018 including crossing I-80 one mile further east or paralleling the north side of I-80. Each of these scenarios also included BLM land.

2. Right-of-Way Location

a. Legal Description

The new transmission line is in the SE1/4SE1/4 of Section 6, T18N R105W and in the NW1/4NW1/4, of Section 32, T19N, R105W.

b. Site specific engineering surveys for critical areas (note: in addition to normal centerline survey)
N/A

c. Maps and drawings showing river crossings

There are no river crossings associated with the project.

d. Acre calculation of the right-of-way by land status

Construction Easement Area (100' wide)

Public land ROW on the project consists of 6.48 acres.

Private land ROW on the project consists of 24.07 acres.

Permanent Easement Area (30' wide)

Public land ROW on the project consists of 1.94 acres.

Private land ROW on the project consists of 10.22 acres.

Additional ROW Described by Footage Only

WYDOT footage is 531 feet

ROW on BLM lands is shown on the attached USGS Exhibits. Exhibit A drawings show and describe the temporary and permanent easements on the BLM in Sections 6 and 32. Exhibit B drawings show an aerial view of the same easement locations. Exhibit 2 shows the location of a temporary staging area in Section 6 which will be used during construction.

3. Facility Design Factors

a. Pipeline pressure standards
The anticipated water pressure in the pipeline through BLM property is estimated to range from 75 psi to 130 psi.

1) Pipe wall thickness and pounds per square inch (psi) rating

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The wall thickness of the PVC pipeline is 1.778 inch and the psi pressure rating is 235 psi.

b. Toxicity of pipeline product

The pipeline will carry treated drinking water

c. Anticipated operating temperatures

The water operating temperature is estimated to range from 40 to 60 degrees F.

d. Depth of the pipeline

The pipeline will be buried approximately 6' below the surface.

e. Permanent width or size

The permanent width of the pipeline right-of-way across BLM property will be 30 feet.

A construction right-of-way width of 70 additional feet is requested for the pipeline.

f. Temporary areas needed

One staging area will be located on BLM property. (See Exhibit 2) It will be located in Section 6 south of I-80 and will required 1.24-acres. The staging area will be used for pipe and equipment storage.

4. Additional Components of the Right-Of-Way

a. Connection to existing right-of-way

1) Existing components on or off public land

The pipeline will connect to existing waterlines on both the south and north ends.

2) Possible future components

There are no plans for future components

b. Location of pumping and/or compressor stations

The location of the proposed pump station will be in T18N R105 W Section 5 W1/2 NW 1/4. It is located on private property. It is shown on attached USGS Exhibit 4.

c. Need for sand and gravel and where it will be obtained

Some material will be needed for bedding material for the pipeline and for base course beneath the pump station. The specification for the bedding and base course are described within the plans and specifications. The source of these materials would be a local supplier.

d. Location of equipment storage

Equipment storage areas will be arranged by the contractors. An area south of Sunset Dr. on BLM property in Section 6 is anticipated to be one storage area. Materials will be stored at these locations. There is no permanent storage planned for the pipeline or pump station.

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5. Governmental Agencies Involved

a. BLM

N/A

b. copy of FERC Sec.7c Application, if applicable

N/A

c. State and local agencies that may be involved

WYDOT, Sweetwater County, City of Rock Springs

6. Construction of the Facilities

a. Construction (brief description)

1) Major facilities (including vehicles and number of tons and loads)

The Joint Powers Water Board plans to construct a 30" diameter PVC treated drinking water transmission line connecting on the south of Interstate 80 to a 20" diameter existing line owned by the Joint Powers Water Board. From the connection point, the line will cross under Interstate 80, Foothill Blvd. and Sunset Blvd. by boring. The pipeline will follow the route shown on the plans avoiding developed parcels of land. The transmission line will cross BLM property in two locations. The boring under Interstate 80 will pass through WYDOT property. Otherwise, it will be located on private property except for a short length which will cross a Sweetwater County Road. The line zig zags north, northeast and northwest to the location where a new pump station will be constructed on private property. The line will continue north from the pump station then northeast then north until it turns west and connects to the existing Wind River Tank which is located on Joint Powers Board property.

Materials for the transmission line will be transported to the section south of Interstate 80 by access along Sunset Dr. and proposed ROW through BLM property and WYDOT ROW. Materials for the line north of Interstate 80 will follow several existing roadways to reach the pipeline ROW. Then the materials will be transported along the ROW.

Materials that will be transported along these routes include pipe and bedding and materials for construction of the pump station. Construction equipment will also follow the roads and right-of-way. Equipment should include track hoes, loaders, dozers, dump trucks, water truck and pickups. The dump trucks will transport bedding.

2) Ancillary facilities (including vehicles and number of tons and loads).

Air/vacuum and gate valves will be located along the pipeline route. They are shown on the plans. The air/vac valves allow air to escape or enter the pipeline during its operation. The gate valves will allow the Board to isolate sections of the pipe should they need repair. These valves will be located in underground vaults directly over the pipe.

b. Work Force (number of people and vehicles)

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The project has not been bid. The workforce will be chosen by the contractor at the time of award. There could be two or more crews working at the same time. Crews may consist of up to 10 workers.

c. Flagging and staking the right-of-way

The 100' right-of-way will be staked on BLM property by the Joint Powers Water Board prior to construction activities.

d. Clearing and grading

The existing sagebrush along the transmission line route will be cleared during the removal of topsoil. The sagebrush will be stored with the topsoil.

The proposed pump station site will be stripped of any topsoil and cleared of any vegetation prior to construction. Grading for the new pump station will follow the drawings in the plans.

e. Facility construction data

1) Description of construction process

The topsoil that exists along the line excavation will be removed and stockpiled on one side of the trench to be replaced once the pipe has been installed and backfilled.

The transmission line will be installed by excavating to the depth of approximately 9 feet as shown on the plans. The PVC pipe sections will be installed in the trench. The process will follow the plans and specifications.

The pump station will have its foundation excavated with base material being added before the footings are installed. This work will follow the plans and specifications.

Time of construction for the project will be 365 days.

f. Access to, and along, right-of-way during construction

Access to and along the right-of-way will follow existing roads that intersect the transmission line route through a portion of BLM property. The line will cross these roads in some locations and may follow along it in others.

Where the road intersects the proposed right-of-way along the pipeline route, materials and equipment will move from the road and along the right-of-way during construction.

g. Engineering drawings and specifications for site-specific problems relating to surface use or special mitigation

No site-specific problems relating to surface use or special mitigation are anticipated.

h. Diagrams, drawings, and cross sections to help visualize the scope of the project

Plans and Specifications for the project are located at the Sunrise Engineering Office, 47 E. 4th Av., Afton, WY, 83110. During construction of the project, copies of the plans and specifications will be onsite in the possession of the contractor and construction observer.

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Also attached is a copy of the USGS Kanda Quadrangle Map which shows the pipeline route as it relates to the surrounding area.

i. Special equipment that will be utilized

No special equipment will be utilized to install the transmission line and lift station.

j. Contingency planning

1) Holder contacts

Green River-Rock Springs-Sweetwater County Joint Powers Water Board (GR/RS/SC Joint Powers Water Board)

Bryan Seppie P.E. General Manager
PO Box 1299
Green River, WY 82935
307-875-4317

Rock Springs Wyoming Department of Engineering

Clint Zambai Water Department Superintendent
212 D Street
Rock Springs, WY 82901
307-352-1405

2) BLM Contacts

Lisa K. Aleshire
Realty Specialist
Rock Springs Field Office
280 Highway 191 N
Rock Springs, WY 82901
307-352-0322

k. Safety requirements

The safety requirements associated with the project will be supervised by the general contractor. That company has not been determined at this time. All OSHA and industry standard safety procedures are anticipated to be followed.

l. Industrial wastes and toxic substances

No industrial wastes or toxic substances are associated with the transmission line and storage tank.

7. Resource Values and Environmental Concerns

a. Address at level commensurate with anticipated impacts

1) Location with regard to existing corridors.

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The transmission line will cross under Interstate 80, Sunset Dr. and Foothill Blvd. approximately 1250 feet north of its connection point with an existing GR/RS/SC Joint Powers Water Board pipeline. Approval from WYDOT will be required for this crossing.

The Union Pacific right-of-way is located just south of where the water transmission line will connect to the existing line.

The project will cross County Road 69 and Crossroads Park Road in Section 32.

b. Anticipated conflicts with resources or public health and safety

1) Air, noise, geologic hazards, mineral and energy resources, paleontological resources, soils, water, vegetation, wildlife, threatened and endangered species, cultural resources visual resources, BLM projects, recreation activities, wilderness, etc.

The BLM will contact the WGF and the USFWS as part of their review. A cultural resources study may be required.

There will be short term air and noise impacts during construction.

8. Stabilization and Rehabilitation

a. Soil replacement and stabilization

The topsoil will be stripped from the excavated trench line and stored adjacent to the trench. Following backfill of the trench, the topsoil will be replaced. The disturbed area will be re-seeded by the contractor with a seed mix design provided by the BLM.

Sage brush sized plants that were removed during excavation will be placed back onto the trench line to help stabilize the soils and discourage traffic along the route.

Carsonite markers will be placed along the pipeline route.

b. Disposal of vegetation removed during construction (i.e., trees, shrubs, etc.)

Large shrubs will be removed from the site and disposed of at an approved location. Sage brush sized plants will be salvaged with the topsoil and placed over the trench line after the soil is replaced.

c. Seeding Specifications

The re-seeding and seed mixture will follow BLM guidelines. The pipeline route will be monitored for weeds following construction until the reseeding has taken.

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d. Fertilizer

N/A

e. Limiting access to the right-of-way

There appears to be numerus existing two track roads in the SE1/4 of the SE1/4 of Section 6 on BLM property where the transmission line connects to the existing waterline. Signs

identifying this as an active reclamation-please stay off, will be placed where the roads intersect the trench line.

In Section 32 there appears to be many two track roads that may be intersected by the transmission line. Signs identifying this as an active reclamation-please stay off, will be placed where the roads intersect the trench line.

f. Will roads built during the construction be reclaimed

There are no new roads proposed for the construction of the transmission line or pump station.

9. Operation and Maintenance

a. Will new or expanded access be needed for operation and maintenance

No new or expanded access will be needed for the operation and maintenance of the transmission line. Travel will take place along the existing roads or along the right-of-way.

b. Will there be hydrostatic testing and subsequent release of water and what is the anticipated volume

The new water transmission line will be hydrostatically tested. It is anticipated that testing will take place every 1000 feet of new line. Release volume from the testing is calculated to be approximately 37,000 gallons per 1000 ft. Test water may be reused by moving from section to section.

c. Will removal and/or addition of pipe and/or pumps be required as part of pipeline maintenance

There is a pump station involved with the transmission line. The only need for removal and or addition of pipe once the line has been installed would be for repairs to a section of the line. It is not anticipated that a new line would need repairs for some time.

d. Will all maintenance activities be confined within the right-of-way?

Access to the right-of-way where a maintenance activity may occur would be along the existing road and then along the right-of-way to the location.

e. Safety

The pipeline will be monitored and maintained through its life of use.

f. Will industrial wastes and toxic substances be generated or stored on right-of-way

No

g. Inspection and maintenance schedule

The pipeline will be inspected several times a year. Any valves on BLM property will be exercised at a regular interval.

1) Will these be conducted on-the-ground and/or by aircraft

The inspections will be conducted on-the-ground

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2) If by aircraft, will the aircraft require landing strips and/or heliport

N/A

h. Work schedules

The contractor awarded the project will set the work schedule. The schedule will not be known prior to the award. It is anticipated work will be complete within 400 days.

i. Fire Control

The contractor will have a water truck on location for dust control. The truck would be available should an accidental fire occur. Fire extinguishers are located on all equipment.

j. Contingency Planning

Emergency Response Plan

The new transmission line will create a redundancy in the Joint Powers Water Board's system and is therefore not critical to the supply of water to the system. The Board will have a schedule of inspection for the line and pump station and will address any issues that may arise.

10. Termination and Restoration

a. Removal of Structures

No structures will be removed with this project on BLM property

b. Will pipe be removed or cleaned and left in ground

At the end of pipe's useful life, it will be left in place.

c. Obliteration of roads

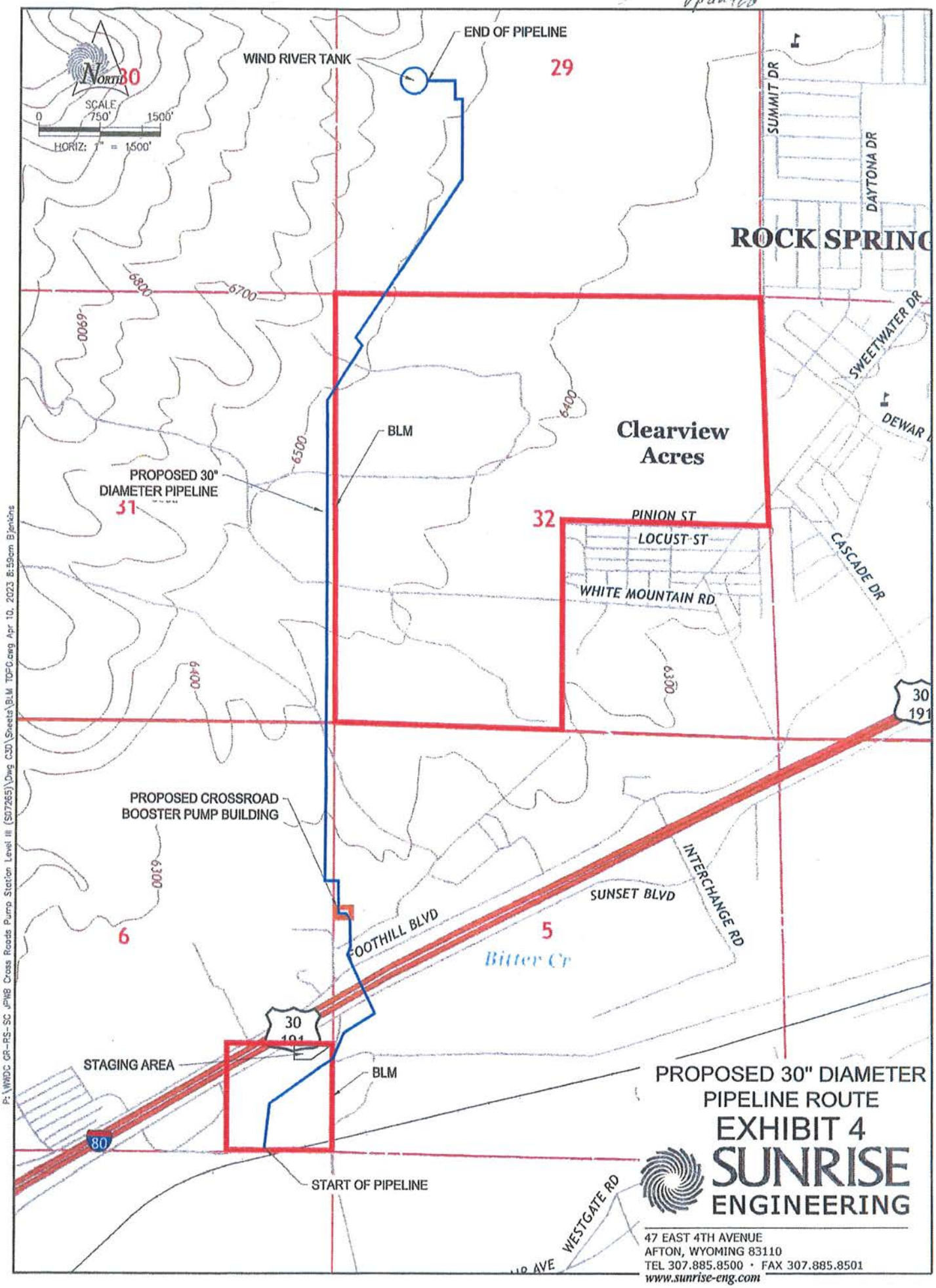
N/A

d. Stabilization and re-vegetation of disturbed areas

Any disturbed areas will be recontoured.

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Rock Springs, Wyoming

Updated



PROPOSED 30" DIAMETER PIPELINE ROUTE

EXHIBIT 4

SUNRISE ENGINEERING
47 EAST 4TH AVENUE
AFTON, WYOMING 83110
TEL 307.885.8500 · FAX 307.885.8501
www.sunrise-eng.com

EXHIBIT B

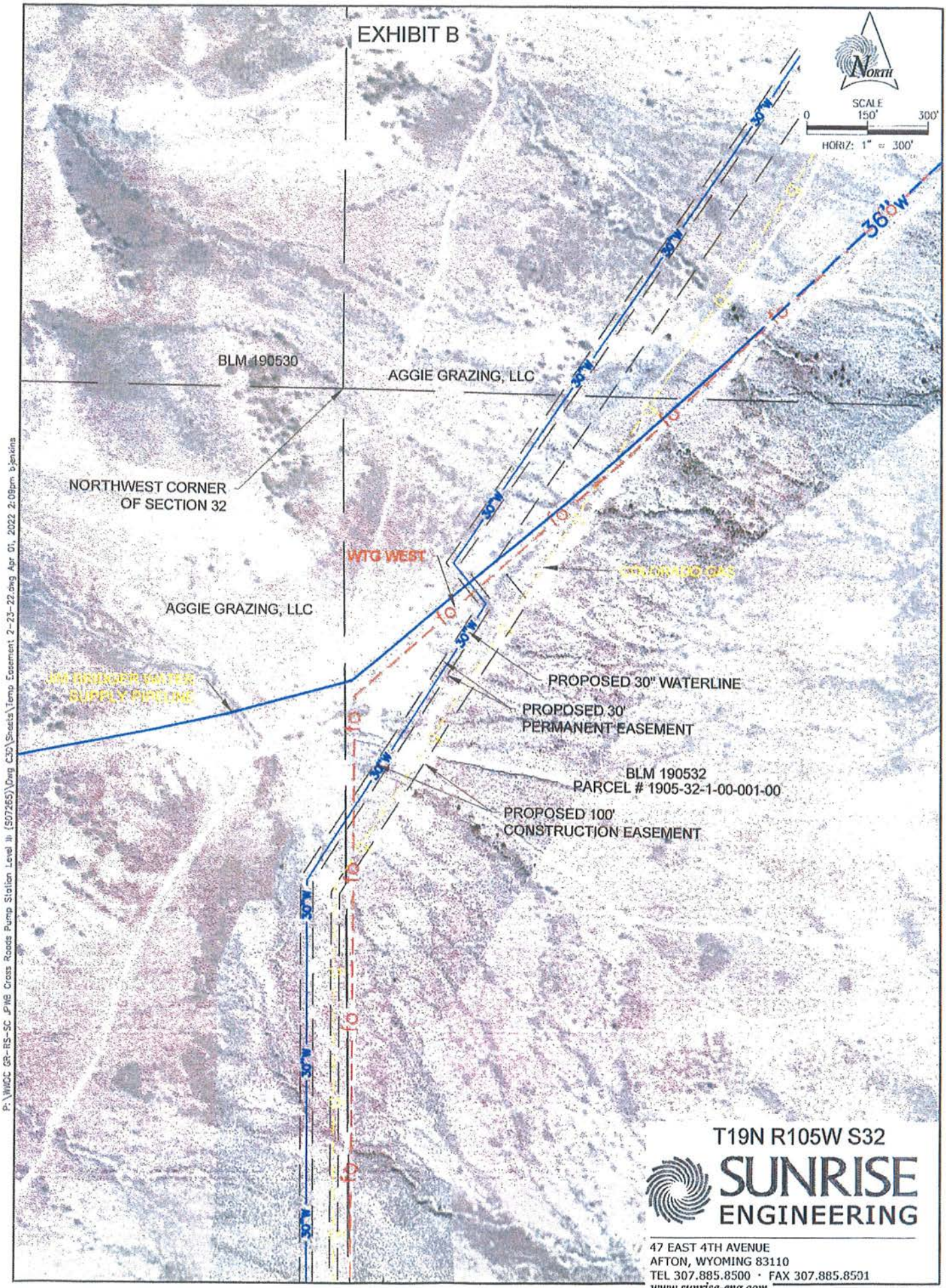
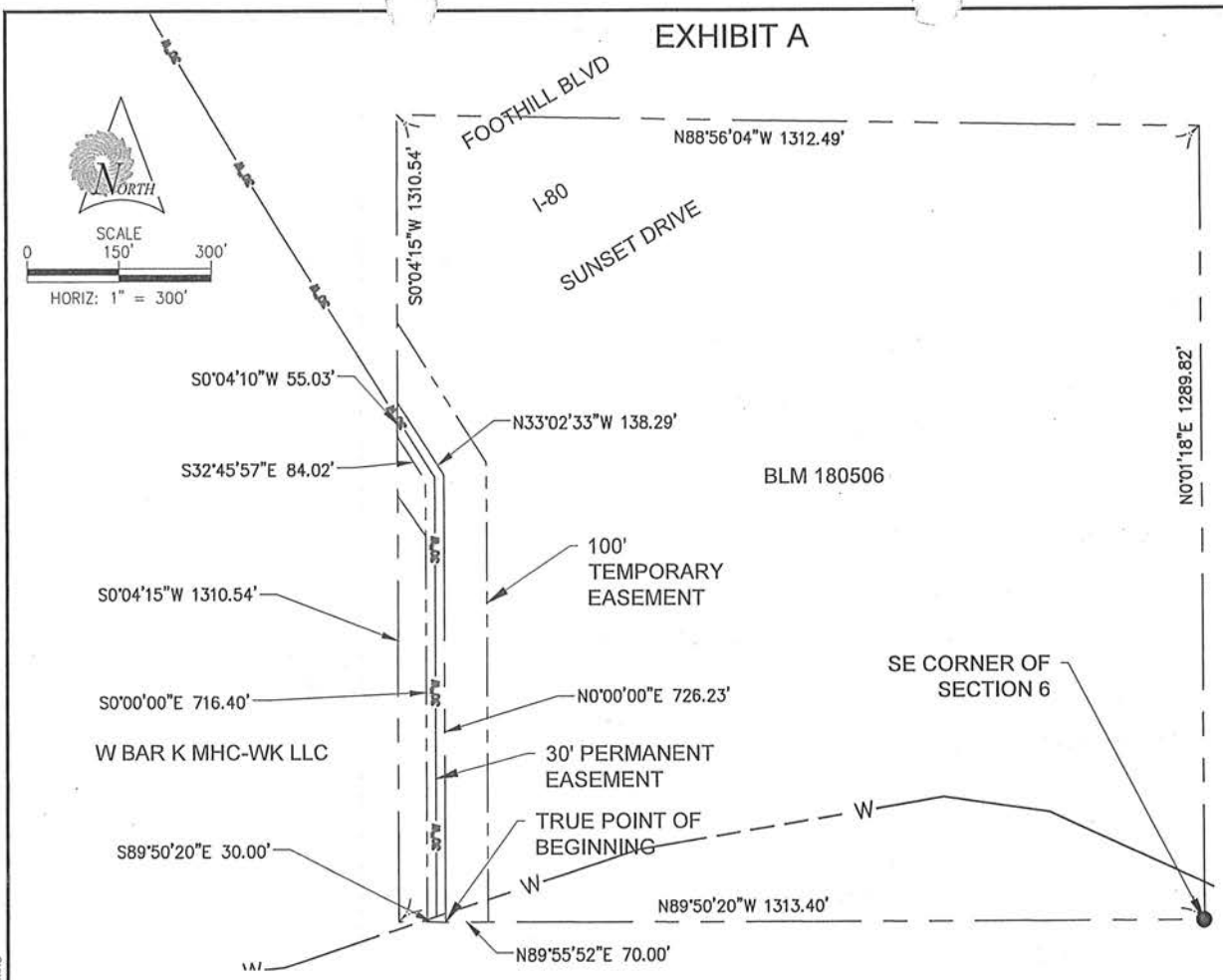

EXHIBIT B
NORTH
SCALE
0
150'
300'
HORIZ: 1" = 300'
30'W
36'W
BLM 190530
AGGIE GRAZING, LLC
NORTHWEST CORNER
OF SECTION 32
WTG WEST
COLORADO GAS
AGGIE GRAZING, LLC
PROPOSED 30" WATERLINE
PROPOSED 30'
PERMANENT EASEMENT
BLM 190532
PARCEL # 1905-32-1-00-001-00
PROPOSED 100'
CONSTRUCTION EASEMENT
T19N R105W S32
SUNRISE
ENGINEERING
47 EAST 4TH AVENUE
AFTON, WYOMING 83110
TEL 307.885.8500 · FAX 307.885.8501
www.sunrise-eng.com
EXHIBIT C

EXHIBIT A



SURVEY DESCRIPTION

A STRIP OF LAND 30 FEET IN WIDTH, SITUATED IN THE SOUTHEAST QUARTER OF SECTION 6, TOWNSHIP 18 NORTH, RANGE 105 WEST, 6TH PRINCIPLE MERIDIAN IN THE COUNTY OF SWEETWATER, STATE OF WYOMING. THE BOUNDARY THEREOF BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHEAST CORNER OF SAID SECTION 6, THENCE N89°50'20"W, 1313.40 FEET TO THE TRUE POINT OF BEGINNING. THENCE N0°00'00" E, 726.23 FEET, THENCE N33°02'33" W, 138.29 FEET, THENCE S0°04'10" W, 55.03 FEET, THENCE S32°45'57" E, 84.02 FEET, THENCE S0°00'00"E 716.40 FEET, THENCE S89°50'20"E 30 FEET TO THE TRUE POINT OF BEGINNING.

EASEMENT CONTAINS .57 ACRES

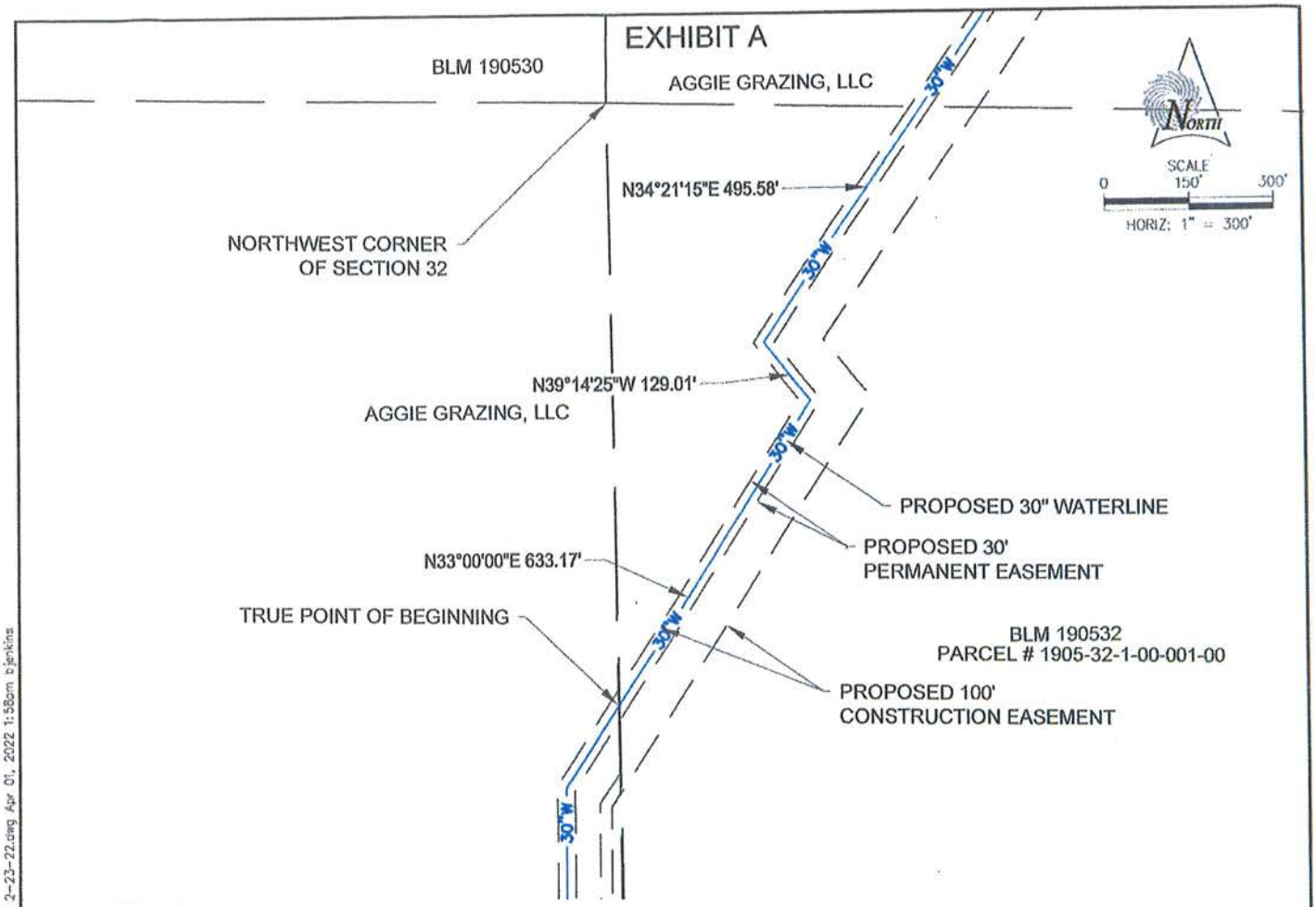
P:\WWDC Cross Roads Pump Station Level III\Dwg C3D\Sheets\Easement.dwg May 21, 2020 2:25pm bjenkins

EXHIBIT FOR EXCLUSIVE
EASEMENT FOR WATERLINE

SUNRISE ENGINEERING
47 EAST 4TH AVENUE
AFTON, WYOMING 83110
TEL 307.885.8500 · FAX 307.885.8501
www.sunrise-eng.com

EXHIBIT D

EXHIBIT A



SURVEY DESCRIPTION

A STRIP OF LAND 30 FEET IN WIDTH, 15 FEET ON EITHER SIDE OF THE FOLLOWING DESCRIBED CENTERLINE:

BEGINNING AT THE NORTHWEST CORNER OF SECTION 32, TOWNSHIP 19 NORTH, RANGE 105 WEST, SIXTH PRINCIPAL MERIDIAN, SWEETWATER COUNTY, WYOMING; THENCE S00°35'53"E, 1053.72 FEET,TO THE TRUE POINT OF BEGINNING. THENCE N33°00'00"E, 633.17 FEET, THENCE N39°14'25"W, 129.01 FEET, THENCE N34°21'15"E, 495.58 FEET, TO THE POINT OF ENDING.

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Rock Springs, Wyoming

EXHIBIT FOR EXCLUSIVE
EASEMENT FOR WATERLINE

SUNRISE ENGINEERING
47 EAST 4TH AVENUE
AFTON, WYOMING 83110
TEL 307.885.8500 · FAX 307.885.8501
www.sunrise-eng.com

EXHIBIT E

P:\WOC GR-RS-SC JPWB Cross Roads Pump Station Level III (S07265)\Dwg C3D\Sheets\Temp Easement 2-23-22.dwg Apr 01, 2022 1:58pm tjenkins

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
High Desert District - Rock Springs Field Office
280 Highway 191 North
Rock Springs, Wyoming 82901-3447
www.blm.gov/wy

In Reply Refer To:
2800 (WYD04)
WYWY106349935

DEC 20 2024

Byran Seppie P.E., General Manager
Joint Powers Water Board
P.O. Box 1299
Green River, Wyoming 82935

Re: Temporary work space

Dear Mr. Seppie:

Enclosed are two copies of right-of-way (R/W) grant offer on Bureau of Land Management (BLM) Form 2800-14, for your proposed temporary workspace and temporary construction width, BLM serial number WYWY106349935. Please review the offer and if it meets with your approval, sign and date in the space provided, and return both copies to the address shown above. Upon receipt of the signed grant offer and the fees discussed below, the BLM will be able to issue the R/W grant absent any other unresolved issues.

The costs the BLM incurs while monitoring the construction and operation of your authorized use is assessed through the monitoring fee. This fee is categorized according to the number of work hours necessary to monitor the approved use and is not refundable. We anticipate your approved use will require a Monitoring Category 2, which involves a fee of $1,085.00. This fee must be paid prior to issuance of the grant.

Please return both signed copies of the grant, and the monitoring fee along with the attached Courtesy Statement to the address above. You are allowed 30 days from receipt of this offer in which to submit the required payments and the executed R/W grant. If these requirements are not met, the application may be denied.

This R/W grant, and the authority to use the lands described in the document, becomes effective on the date it is signed by an authorized officer of the BLM. A copy of the R/W grant will be returned to you when signed by the authorized officer.

If you have any questions, please contact Lisa Aleshire, at 307-352-0377or by email at laleshire@blm.gov.

Sincerely,

Kimberlee D. Foster
Field Manager

Attachments

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Courtesy Statement

Bill Number: 2025012848

Date: 12/20/2024

Make Remittance Payable To *DOI/BLM* and Mail To:
ROCK SPRINGS FIELD OFFICE
280 US HIGHWAY 191
ROCK SPRINGS, WY 82901
(307)352-0256

Please include bill number on all remittances.

Payor: JOINT POWERS WATER BOARD
PO BOX 1299
GREEN RIVER, WY 82935-1299 US

DATE	DESCRIPTION	AMOUNT
	WYWY106349935 ROW MONITORING FEDERAL LAND POLICY AND MANAGEMENT ACT OF 1976 CAT 2 **$1,085.00**	$1,085.00
	BLM CONTACT: ROCK SPRINGS FIELD O, (307)352-0256	
	AMOUNT DUE THIS BILL:	**$1,085.00**

- BLM Tax ID #84-0437540
- **See attached Payment Instructions and Details.**
- **If the above name and address is incorrect, please contact the BLM office listed above.**

This Bill was generated by the automated BLM Collections and Billings System and is a paper representation of a portion of the official electronic record contained therein.

PAYMENT INSTRUCTIONS AND DETAILS

Revised 06/07/2021

- Please return a copy of this Bill for Collection, Advance Bill Notice, or Courtesy Statement with payment or include the Bill Number on your remittance.

- Payment can be made by cash, check, money order or credit card (VISA, MasterCard, Discover, and American Express) or by Electronic Fund Transfer (EFT) via automated clearing house (ACH) or wire transfer.

Notice to Customers Making Payment by Check

- When you provide a check as payment, you authorize BLM either to use information from your check to make a one-time electronic fund transfer from your account or to process the payment as a check transaction.

  Privacy Act - A Privacy Act Statement required by 5 U.S.C. §552a(e)(3) stating our authority for soliciting and collecting the information from your check, and explaining the purposes and routine uses which will be made of your check information, is available from the Federal Register at:

  https://www.federalregister.gov/articles/2003/02/04/03-2521/privacy-act-of-1974-as-amended-system-of-records

  or by calling toll free (at 1-866-945-7920) to obtain a copy by mail. Furnishing the check information is voluntary, but a decision not to do so may require you to make payment by some other method.

- Make checks or money orders payable to DOI/BLM.

Notice to Customers Making Payment via Credit Card

- To pay by credit card, complete the credit card payment form (attached) and return to the billing office.

- Call the office listed on the Bill for Collection to make payment by phone.

- You may use debit cards with the VISA or MasterCard logo.

- Effective June 1, 2015 - credit card payments can only be accepted for amounts of $24,999.99 or less.

Notice to Customers Making Payment via Electronic Payment

- See attached document for details.

Information required when paying the BLM WITH CREDIT CARD	
Cardholder Name	
Amount Paid (Effective 6/1/2015 amount cannot exceed $24,999.99)	$
Bill for Collection Number	
Credit Card Type	VISA ☐ MC ☐ DISCOVER ☐ AMERICAN EXPRESS ☐
Credit Card Number	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
Credit Card Expiration Date	MONTH ☐☐ YEAR ☐☐☐☐
Phone Number (Required)	( ) -
Signature (Required)	

Information collected from this form may be subject to the requirements of the Privacy Act (5 U.S.C. 552a). This form is used solely as a method of payment for goods and or services provided to federal agencies, businesses and private individuals by the Bureau of Land Management. The information collected will be stored in a secure location with access limited to designated employees. Any information collected may be subject to disclosure, but will be handled in accordance with the Privacy Act and Freedom of Information Act (FOIA) requirements to ensure protection of personal privacy in the face of required disclosure. Information will not be shared with outside parties except as required by law.

It is a crime for any person knowingly and willfully to make any department or agency of the United States any false, fictitious or fraudulent statement or representations as to any matter within its jurisdiction. (Title 18 U.S.C. Section 1001)

(Cut here and return to BLM)

BLM Information your bank requires when paying the BLM ELECTRONICALLY (ACH)	
FIELD NAME	**REQUIRED INFORMATION**
BLM's ACH Account Number	312051
ACH ABA Number	051036706
Company/Individual Name	BLM's Office Name (Example - Wyoming State Office) and BLM POC
Identification Number	BLM Bill Number
BLM's ACH Bank Address **Phone 800-624-1373**	CASH LINK-ACH RECEIVER 5700 Rivertech Court Riverdale MD 20737
BLM's Address	Bureau of Land Management Building 50, Denver Federal Center, PO Box 25047 Denver, CO 80225-0047
BLM Contact Information	CBS Customer Service Desk at 303-236-6795

You are responsible for any fees your financial institution may charge you for the actual transfer of funds. Please verify additional fees charged by your financial institution are not deducted from payment.

BLM Information your bank requires when paying the BLM ELECTRONICALLY(WIRE TRANSFER)	
FIELD NAME	**REQUIRED INFORMATION**
Receiver DI Number/ Financial Institution	021030004 / Treasury NYC
Beneficiary Identifier/Account Number	14110008
Beneficiary Name	Bureau of Land Management (BLM)
Originator to Beneficiary Information	BLM Bill Number /BLM's Office Name (Example Wyoming State Office)
BLM Contact Information	CBS Customer Service Desk at 303-236-6795
Financial Institution Address	TREASURY NYC 401 14th Street SW Washington, DC 20327
BLM's Tax ID#	84-0437540

You are responsible for any fees your financial institution may charge you for the actual transfer of funds. Please verify additional fees charged by your financial institution are not deducted from payment.

FORM 2800-14
(August 1985)

Issuing Office
Rock Springs Field Office

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
TEMPORARY USE PERMIT

SERIAL NUMBER WYWY106349935

---

1. A right-of-way is hereby granted pursuant to Title V of the Federal Land Policy and Management Act of October 21, 1976 (90 Stat. 2776; 43 U.S.C. 1761).

2. Nature of Interest:

   a. By this instrument, the holder:

   Joint Powers Water Board
   P.O. Box 1299
   Green River, Wyoming 82935

   receives a right to construct, operate, maintain, and terminate a buried water pipeline, on public lands described as follows:

   Sixth Principal Meridian, Wyoming
   T. 18 N., R. 105 W.,
   sec. 6, SE1/4SE1/4;
   T. 19 N., R. 105 W.,
   sec. 32, lot 4.

   b. The right-of-way or permit area granted herein is 70 feet wide, 2,821 feet long and contains 4.53 acres, more or less.

   The temporary staging area permit area granted herein is 1.25 acres.

   c. This instrument shall terminate on December 31, 2027, 3 years from its effective date unless, prior thereto, it is relinquished, abandoned, terminated, or modified pursuant to the terms and conditions of this instrument or of any applicable Federal law or regulation.

   d. This instrument may be renewed. If renewed, the right-of-way or permit shall be subject to the regulations existing at the time of the renewal and any other terms and conditions that the authorized officer deems necessary to protect the public interest.

   e. Notwithstanding the expiration of this instrument or any renewal thereof, early

relinquishment, abandonment, or termination, the provisions of this instrument, to the extent applicable, shall continue in effect and shall be binding on the holder, its successors, or assigns, until they have fully satisfied the obligations and/or liabilities accruing herein before or on account of the expiration, or prior termination, of the grant.

3. Rental

For and in consideration of the rights granted, the holder agrees to pay the Bureau of Land Management fair market value rental as determined by the authorized officer unless specifically exempted from such payment by regulation. Provided, however, that the rental may be adjusted by the authorized officer, whenever necessary, to reflect changes in the fair market rental value as determined by the application of sound business management principles, and so far as practicable and feasible, in accordance with comparable commercial practices.

4. Terms and Conditions:

a. This grant or permit is issued subject to the holder's compliance with all applicable regulations contained in Title 43 Code of Federal Regulations part 2800 and 2880.

b. Upon grant termination by the authorized officer, all improvements shall be removed from the public lands within 90 days, or otherwise disposed of as provided in paragraph (4)(d) or as directed by the authorized officer.

c. Each grant issued for a term of 20 years or more shall, at a minimum, be reviewed by the authorized officer at the end of the 20th year and at regular intervals thereafter not to exceed 10 years. Provided, however, that a right-of-way or permit granted herein may be reviewed at any time deemed necessary by the authorized officer.

d. The stipulations, plans, maps, or designs set forth in Exhibits A, B, C, and D dated, May 9, 2023, attached hereto, are incorporated into and made a part of this grant instrument as fully and effectively as if they were set forth herein in their entirety.

e. Failure of the holder to comply with applicable law or any provision of this right-of-way grant or permit shall constitute grounds for suspension or termination thereof.

f. The holder shall perform all operations in a good and workmanlike manner so as to ensure protection of the environment and the health and safety of the public.

g. The holder shall contact the authorized officer at least FIVE days prior to the anticipated start of construction and/or any surface disturbing activities. The authorized officer may

require and schedule a preconstruction conference with the holder prior to the holder's commencing construction and/or surface disturbing activities on the right-of-way. The holder and/or his representative shall attend this conference. The holder's contractor, or agents involved with construction and/or any surface disturbing activities associated with the right-of-way, shall also attend this conference to review the stipulations of the grant including the plan(s) of development.

h. In the event that the public land underlying the right-of-way (ROW) encompassed in this grant, or a portion thereof, is conveyed out of Federal ownership and administration of the ROW or the land underlying the ROW is not being reserved to the United States in the patent/deed and/or the ROW is not within a ROW corridor being reserved to the United States in the patent/deed, the United States waives any right it has to administer the right-of-way, or portion thereof, within the conveyed land under Federal laws, statutes, and regulations, including the regulations at 43 CFR Part 2800, including any rights to have the holder apply to BLM for amendments, modifications, or assignments and for BLM to approve or recognize such amendments, modifications, or assignments. At the time of conveyance, the patentee/grantee, and their successors and assigns, shall succeed to the interests of the United States in all matters relating to the right-of-way, or portion thereof, within the conveyed land and shall be subject to applicable State and local government laws, statutes, and ordinances. After conveyance, any disputes concerning compliance with the use and the terms and conditions of the ROW shall be considered a civil matter between the patentee/grantee and the ROW Holder.

i. A bond, acceptable to the authorized officer, shall be furnished by the holder before execution of the grant or at such earlier date as may be specified by the authorized officer. The amount of this bond shall be determined by a Reclamation Cost Estimate submitted by the holder and approved by the authorized officer. This bond must be maintained in effect until removal of improvements and restoration of the R/W have been accepted by the authorized officer.

j. The holder agrees that all monies deposited with the authorized officer as security for holder's performance of the terms and conditions of this grant may, upon failure on the holder's part to fulfill any of the requirements herein set forth or made a part hereof, be retained by the United States to be applied as far as may be needed to satisfaction of the holder's obligations assumed hereunder, without prejudice whatever to any other rights and remedies of the United States.

k. Should the bond delivered under this grant become unsatisfactory to the authorized officer, the holder shall, within 30 days of demand, furnish a new bond.

l. Within 30 days of completion, the holder will submit to the authorized officer, as-built drawings and a certification of construction verifying that the facility has been constructed (and tested) in accordance with the design, plans, specifications, and

applicable laws and regulations.

m. The United States, its officers and employees shall be held harmless from and indemnified against any damage, injury, or liability resulting from the construction, operation, or maintenance of the facility being authorized by this right-of-way grant, including but not limited to any liability which the United States may have as owner of the land which is the subject of the right-of-way grant.

n. Construction activity and surface disturbance will be prohibited during the period of November 15 through April 30 for the protection of big game crucial winter range. Any exceptions to this requirement must have prior written approval from the authorized officer.

o. Construction activity and surface disturbance will be prohibited during the period of February 1 through July 31 for the protection of raptors. Any exceptions to this requirement must have prior written approval from the authorized officer.

p. The holder shall construct, operate, and maintain the facilities, improvements, and structures within this right-of-way in strict conformity with the plan(s) of development which was (were) approved and made part of the grant on _____. Any relocation, additional construction, or use that is not in accord with the approved plan(s) of development, shall not be initiated without the prior written approval of the authorized officer. A copy of the complete right-of-way grant, including all stipulations and approved plan(s) of development, shall be made available on the right-of-way area during construction, operation, and termination to the authorized officer. Noncompliance with the above will be grounds for an immediate temporary suspension of activities if it constitutes a threat to public health and safety or the environment.

q. The holder shall designate a representative(s) who shall have the authority to act upon and to implement instructions from the authorized officer. The holder's representative shall be available for communication with the authorized officer within a reasonable time when construction or other surface disturbing activities are underway.

r. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the authorized officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer. An evaluation of the discovery will be made by the authorized officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the authorized officer after consulting with the holder.

s. A certified archeologist will be on site at all times during construction, where the pipeline crosses the Lincoln Highway. Any cultural materials located during construction will be reported to the authorized officer. Procedures for determining significance and/or effect will be established at that time. Cost of any further cultural work will be borne by the holder.

t. The holder shall recontour disturbed areas, or designated sections of the right-of-way, located in T. 18 N., R. 105 W., section 6, to preexisting conditions, by grading the site to approximately the original contour of the ground as determined by the authorized officer.

u. A certified paleontologist who meets or exceeds the qualification standards recommended by the Secretary of the Interior will inspect the open pipeline trench after construction and before the pipeline is placed into the trench. Any paleontological materials located during construction will be reported to the authorized officer. Procedures for determining the significance and/or effect will be established at that time. Cost of any further paleontological work will be borne by the holder.

v. Seed shall be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture shall be evenly and uniformly planted over the disturbed area (smaller/heavier seeds have a tendency to drop to the bottom of the drill and are planted first.) The holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed shall be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre noted below are to be doubled. The seeding will be repeated until a satisfactory stand is established as determined by the authorized officer. Evaluation of growth will not be made before completion of the first growing season after seeding. The authorized officer is to be notified a minimum of 5 working days prior to seeding of the project.

Seed Mixture B

Grasses – USE ALL	
Needle and thread grass	6 lbs/acre
Thickspike wheatgrass	6
Indian ricegrass	3
Bottlebrush squirreltail	2
Bluebunch wheatgrass	2
Shrubs - USE TWO	
Shadscale	1 lb/acre

Spiny hopsage	1
Forbs – USE TWO	
Northern sweetvetch	1/2 lb/acre
Rocky Mountain beeplant	1/2 lb/acre
Louisiana (prairie) sagebrush	1/2 lb/acre

Pure Live Seed (PLS) formula: % of purity of seed mixture times % germination of seed mixture = portion of seed mixture that is PLS

w. Use of pesticides shall comply with the applicable Federal and state laws. Pesticides shall be used only in accordance with their registered uses and within limitations imposed by the Secretary of the Interior. Prior to the use of pesticides, the holder shall obtain from the authorized officer written approval of a plan showing the type and quantity of material to be used, pest(s) to be controlled, method of application, location of storage and disposal of containers, and any other information deemed necessary by the authorized officer. Emergency use of pesticides shall be approved in writing by the authorized officer prior to such use.

x. The holder shall be responsible for weed control on disturbed areas within the limits of the right-of-way. The holder is responsible for consultation with the authorized officer and/or local authorities for acceptable weed control methods (within limits imposed in the grant stipulations).

y. The holder shall protect all survey monuments found within the right-of-way. Survey monuments include, but are not limited to, General Land Office and Bureau of Land Management Cadastral Survey Corners, reference corners, witness points, U.S. Coastal and Geodetic benchmarks and triangulation stations, military control monuments, and recognizable civil (both public and private) survey monuments. In the event of obliteration or disturbance of any of the above, the holder shall immediately report the incident, in writing, to the authorized office and the respective installing authority if known. Where General Land Office or Bureau of Land Management right-of-way monuments or references are obliterated during operations, the holder shall secure the services of a registered land surveyor or a Bureau cadastral surveyor to restore the disturbed monuments and reference using surveying procedures found in the Manual of Surveying Instructions for the Survey of the Public Lands in the United States, latest edition. The holder shall record such survey in the appropriate county and send a copy to the authorized officer. If the Bureau cadastral surveyors or other Federal surveyors are used to restore the disturbed survey monument, the holder shall by responsible for the survey cost.

z. No construction or routine maintenance activities shall be performed during periods when the soil is too wet to adequately support construction equipment or when watershed damage is likely to occur. If such equipment creates ruts in excess of four inches deep, the soil shall be deemed too wet to adequately support construction equipment. Frozen soil or soil mixed with snow will not be used in construction.

aa. The holder shall meet Federal, State, and local emission standards for air quality.

bb. Construction-related traffic shall be restricted to routes approved by the authorized officer. New access roads or cross-country vehicle travel will not be permitted unless prior written approval is given by the authorized officer. Authorized roads used by the holder shall be rehabilitated or maintained when construction activities are complete as approved by the authorized officer.

cc. Except rights-of-way expressly authorizing a road after construction of the facility is completed, the holder shall not use the right-of-way as a road for purposes other than routine maintenance as determined necessary by the authorized officer in consultation with the holder.

dd. Prior to termination of the right-of-way, the holder shall contact the authorized officer to arrange a joint inspection of the right-of-way. This inspection will be held to agree to an acceptable termination (and rehabilitation) plan. This plan shall include, but is not limited to, removal of facilities, drainage structures, or surface material, recontouring, topsoiling, or seeding. The authorized officer must approve the plan in writing prior to the holder's commencement of any termination activities.

IN WITNESS WHEREOF, The undersigned agrees to the terms and conditions of this right-of-way grant or permit.

_____	_____
(Signature of Holder)	(Signature of Authorized Officer)
_____	_____ Field Manager _____
(Printed Name and Title)	(Title)
_____	_____
(Date)	(Effective Date of Grant)

EXHIBIT A" (Revised 4-27-23)

GREEN RIVER, ROCK SPRINGS, SWEETWATER COUNTY JOINT POWERS WATER BOARD

CONSTRUCTION, OPERATION AND MAINTENANCE PLAN

CULINARY WATER TRANSMISSION LINE AND PUMP STATION

Green River-Rock Springs-Sweetwater County Joint Powers Water Board applies for a Right-of-Way for a new treated drinking water transmission line.

1. PURPOSE and NEED FOR ROW FACILITY

a. What will be constructed

The Joint Powers Water Board (JPWB) plans to construct a 30" diameter PVC culinary water transmission line connecting on the south to the existing Green River-Rock Springs-Sweetwater County Joint Powers Water Board pipeline which lies on Union Pacific Right-of-Way property in the SE Quarter of Section 6, T18N, R105W. The transmission line will follow the route shown on the attached plan set. It will connect to a proposed pump station on private property located in the NW Quarter of Section 5, T18 N, R105W. From the pump station, the transmission line will continue north passing through Section 6, T18 N, R 105 W and Sections 29, 31 and 32 of T19N, R105W. The transmission line will connect with the existing Wind River Tank in the SW Quarter of Section 29, T19N, R105W.

A new 900-foot overhead power line will be installed to supply electricity to the proposed pump station.

See the attached Exhibit 4 for locations of the facilities.

b. Commodity to be transported and for what purpose

The pipeline and pump station will transport treated drinking water for the benefit of those living in the Green River, Rock Springs, Sweetwater County Joint Powers Water Board service territory.

c. Is the pipeline for a gathering system, trunk line, or distribution system

The pipeline would be considered a transmission line through BLM property.

d. Will it be surface or subsurface
Subsurface

e. Length and width of the right-of-way and the area needed for related facilities

The length of the waterline on BLM land for this project is 1,563 ft in Section 6 (T18N, R105W) and 1,258 ft in Section 32 (T19N, R105W) for a total of 2,821 ft. The permanent ROW width will be 30 ft making a total permanent ROW area of 1.94 acres. An additional 70 ft of temporary ROW is requested for construction with an area of 4.54 acres.

The pump station and support utilities will be located on private property.

f. Is this ancillary to an existing right-of-way

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No

g. List alternative routes or locations

The proposed pipeline route has been selected by the Joint Powers Water Board. Multiple routes were investigated during the WWDC Study which was conducted in 2018 including crossing I-80 one mile further east or paralleling the north side of I-80. Each of these scenarios also included BLM land.

2. Right-of-Way Location

a. Legal Description

The new transmission line is in the SE1/4SE1/4 of Section 6, T18N R105W and in the NW1/4NW1/4, of Section 32, T19N, R105W.

b. Site specific engineering surveys for critical areas (note: in addition to normal centerline survey)
N/A

c. Maps and drawings showing river crossings

There are no river crossings associated with the project.

d. Acre calculation of the right-of-way by land status

Construction Easement Area (100' wide)

Public land ROW on the project consists of 6.48 acres.

Private land ROW on the project consists of 24.07 acres.

Permanent Easement Area (30' wide)

Public land ROW on the project consists of 1.94 acres.

Private land ROW on the project consists of 10.22 acres.

Additional ROW Described by Footage Only

WYDOT footage is 531 feet

ROW on BLM lands is shown on the attached USGS Exhibits. Exhibit A drawings show and describe the temporary and permanent easements on the BLM in Sections 6 and 32. Exhibit B drawings show an aerial view of the same easement locations. Exhibit 2 shows the location of a temporary staging area in Section 6 which will be used during construction.

3. Facility Design Factors

a. Pipeline pressure standards

The anticipated water pressure in the pipeline through BLM property is estimated to range from 75 psi to 130 psi.

1) Pipe wall thickness and pounds per square inch (psi) rating

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The wall thickness of the PVC pipeline is 1.778 inch and the psi pressure rating is 235 psi.

b. Toxicity of pipeline product

The pipeline will carry treated drinking water

c. Anticipated operating temperatures

The water operating temperature is estimated to range from 40 to 60 degrees F.

d. Depth of the pipeline

The pipeline will be buried approximately 6' below the surface.

e. Permanent width or size

The permanent width of the pipeline right-of-way across BLM property will be 30 feet.

A construction right-of-way width of 70 additional feet is requested for the pipeline.

f. Temporary areas needed

One staging area will be located on BLM property. (See Exhibit 2) It will be located in Section 6 south of I-80 and will required 1.24-acres. The staging area will be used for pipe and equipment storage.

4. Additional Components of the Right-Of-Way

a. Connection to existing right-of-way

1) Existing components on or off public land

The pipeline will connect to existing waterlines on both the south and north ends.

2) Possible future components

There are no plans for future components

b. Location of pumping and/or compressor stations

The location of the proposed pump station will be in T18N R105 W Section 5 W1/2 NW 1/4. It is located on private property. It is shown on attached USGS Exhibit 4.

c. Need for sand and gravel and where it will be obtained

Some material will be needed for bedding material for the pipeline and for base course beneath the pump station. The specification for the bedding and base course are described within the plans and specifications. The source of these materials would be a local supplier.

d. Location of equipment storage

Equipment storage areas will be arranged by the contractors. An area south of Sunset Dr. on BLM property in Section 6 is anticipated to be one storage area. Materials will be stored at these locations. There is no permanent storage planned for the pipeline or pump station.

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5. Governmental Agencies Involved

a. BLM

N/A

b. copy of FERC Sec.7c Application, if applicable

N/A

c. State and local agencies that may be involved

WYDOT, Sweetwater County, City of Rock Springs

6. Construction of the Facilities

a. Construction (brief description)

1) Major facilities (including vehicles and number of tons and loads)

The Joint Powers Water Board plans to construct a 30" diameter PVC treated drinking water transmission line connecting on the south of Interstate 80 to a 20" diameter existing line owned by the Joint Powers Water Board. From the connection point, the line will cross under Interstate 80, Foothill Blvd. and Sunset Blvd. by boring. The pipeline will follow the route shown on the plans avoiding developed parcels of land. The transmission line will cross BLM property in two locations. The boring under Interstate 80 will pass through WYDOT property. Otherwise, it will be located on private property except for a short length which will cross a Sweetwater County Road. The line zig zags north, northeast and northwest to the location where a new pump station will be constructed on private property. The line will continue north from the pump station then northeast then north until it turns west and connects to the existing Wind River Tank which is located on Joint Powers Board property.

Materials for the transmission line will be transported to the section south of Interstate 80 by access along Sunset Dr. and proposed ROW through BLM property and WYDOT ROW. Materials for the line north of Interstate 80 will follow several existing roadways to reach the pipeline ROW. Then the materials will be transported along the ROW.

Materials that will be transported along these routes include pipe and bedding and materials for construction of the pump station. Construction equipment will also follow the roads and right-of-way. Equipment should include track hoes, loaders, dozers, dump trucks, water truck and pickups. The dump trucks will transport bedding.

2) Ancillary facilities (including vehicles and number of tons and loads).

Air/vacuum and gate valves will be located along the pipeline route. They are shown on the plans. The air/vac valves allow air to escape or enter the pipeline during its operation. The gate valves will allow the Board to isolate sections of the pipe should they need repair. These valves will be located in underground vaults directly over the pipe.

b. Work Force (number of people and vehicles)

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The project has not been bid. The workforce will be chosen by the contractor at the time of award. There could be two or more crews working at the same time. Crews may consist of up to 10 workers.

c. Flagging and staking the right-of-way

The 100' right-of-way will be staked on BLM property by the Joint Powers Water Board prior to construction activities.

d. Clearing and grading

The existing sagebrush along the transmission line route will be cleared during the removal of topsoil. The sagebrush will be stored with the topsoil.

The proposed pump station site will be stripped of any topsoil and cleared of any vegetation prior to construction. Grading for the new pump station will follow the drawings in the plans.

e. Facility construction data

1) Description of construction process

The topsoil that exists along the line excavation will be removed and stockpiled on one side of the trench to be replaced once the pipe has been installed and backfilled.

The transmission line will be installed by excavating to the depth of approximately 9 feet as shown on the plans. The PVC pipe sections will be installed in the trench. The process will follow the plans and specifications.

The pump station will have its foundation excavated with base material being added before the footings are installed. This work will follow the plans and specifications.

Time of construction for the project will be 365 days.

f. Access to, and along, right-of-way during construction

Access to and along the right-of-way will follow existing roads that intersect the transmission line route through a portion of BLM property. The line will cross these roads in some locations and may follow along it in others.

Where the road intersects the proposed right-of-way along the pipeline route, materials and equipment will move from the road and along the right-of-way during construction.

g. Engineering drawings and specifications for site-specific problems relating to surface use or special mitigation

No site-specific problems relating to surface use or special mitigation are anticipated.

h. Diagrams, drawings, and cross sections to help visualize the scope of the project

Plans and Specifications for the project are located at the Sunrise Engineering Office, 47 E. 4th Av., Afton, WY, 83110. During construction of the project, copies of the plans and specifications will be onsite in the possession of the contractor and construction observer.

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Also attached is a copy of the USGS Kanda Quadrangle Map which shows the pipeline route as it relates to the surrounding area.

i. Special equipment that will be utilized

No special equipment will be utilized to install the transmission line and lift station.

j. Contingency planning

1) Holder contacts

Green River-Rock Springs-Sweetwater County Joint Powers Water Board (GR/RS/SC Joint Powers Water Board)

Bryan Seppie P.E. General Manager
PO Box 1299
Green River, WY 82935
307-875-4317

Rock Springs Wyoming Department of Engineering

Clint Zambai Water Department Superintendent
212 D Street
Rock Springs, WY 82901
307-352-1405

2) BLM Contacts

Lisa K. Aleshire
Realty Specialist
Rock Springs Field Office
280 Highway 191 N
Rock Springs, WY 82901
307-352-0322

k. Safety requirements

The safety requirements associated with the project will be supervised by the general contractor. That company has not been determined at this time. All OSHA and industry standard safety procedures are anticipated to be followed.

l. Industrial wastes and toxic substances

No industrial wastes or toxic substances are associated with the transmission line and storage tank.

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7. Resource Values and Environmental Concerns

a. Address at level commensurate with anticipated impacts

1) Location with regard to existing corridors.

The transmission line will cross under Interstate 80, Sunset Dr. and Foothill Blvd. approximately 1250 feet north of its connection point with an existing GR/RS/SC Joint Powers Water Board pipeline. Approval from WYDOT will be required for this crossing.

The Union Pacific right-of-way is located just south of where the water transmission line will connect to the existing line.

The project will cross County Road 69 and Crossroads Park Road in Section 32.

b. Anticipated conflicts with resources or public health and safety

1) Air, noise, geologic hazards, mineral and energy resources, paleontological resources, soils, water, vegetation, wildlife, threatened and endangered species, cultural resources visual resources, BLM projects, recreation activities, wilderness, etc.

The BLM will contact the WGF and the USFWS as part of their review. A cultural resources study may be required.

There will be short term air and noise impacts during construction.

8. Stabilization and Rehabilitation

a. Soil replacement and stabilization

The topsoil will be stripped from the excavated trench line and stored adjacent to the trench. Following backfill of the trench, the topsoil will be replaced. The disturbed area will be re-seeded by the contractor with a seed mix design provided by the BLM.

Sage brush sized plants that were removed during excavation will be placed back onto the trench line to help stabilize the soils and discourage traffic along the route.

Carsonite markers will be placed along the pipeline route.

b. Disposal of vegetation removed during construction (i.e., trees, shrubs, etc.)

Large shrubs will be removed from the site and disposed of at an approved location. Sage brush sized plants will be salvaged with the topsoil and placed over the trench line after the soil is replaced.

c. Seeding Specifications

The re-seeding and seed mixture will follow BLM guidelines. The pipeline route will be monitored for weeds following construction until the reseeding has taken.

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d. Fertilizer

N/A

e. Limiting access to the right-of-way

There appears to be numerus existing two track roads in the SE1/4 of the SE1/4 of Section 6 on BLM property where the transmission line connects to the existing waterline. Signs

identifying this as an active reclamation-please stay off, will be placed where the roads intersect the trench line.

In Section 32 there appears to be many two track roads that may be intersected by the transmission line. Signs identifying this as an active reclamation-please stay off, will be placed where the roads intersect the trench line.

f. Will roads built during the construction be reclaimed

There are no new roads proposed for the construction of the transmission line or pump station.

9. Operation and Maintenance

a. Will new or expanded access be needed for operation and maintenance

No new or expanded access will be needed for the operation and maintenance of the transmission line. Travel will take place along the existing roads or along the right-of-way.

b. Will there be hydrostatic testing and subsequent release of water and what is the anticipated volume

The new water transmission line will be hydrostatically tested. It is anticipated that testing will take place every 1000 feet of new line. Release volume from the testing is calculated to be approximately 37,000 gallons per 1000 ft. Test water may be reused by moving from section to section.

c. Will removal and/or addition of pipe and/or pumps be required as part of pipeline maintenance

There is a pump station involved with the transmission line. The only need for removal and or addition of pipe once the line has been installed would be for repairs to a section of the line. It is not anticipated that a new line would need repairs for some time.

d. Will all maintenance activities be confined within the right-of-way?

Access to the right-of-way where a maintenance activity may occur would be along the existing road and then along the right-of-way to the location.

e. Safety

The pipeline will be monitored and maintained through its life of use.

f. Will industrial wastes and toxic substances be generated or stored on right-of-way

No

g. Inspection and maintenance schedule

The pipeline will be inspected several times a year. Any valves on BLM property will be exercised at a regular interval.

1) Will these be conducted on-the-ground and/or by aircraft

The inspections will be conducted on-the-ground

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2) If by aircraft, will the aircraft require landing strips and/or heliport

N/A

h. Work schedules

The contractor awarded the project will set the work schedule. The schedule will not be known prior to the award. It is anticipated work will be complete within 400 days.

i. Fire Control

The contractor will have a water truck on location for dust control. The truck would be available should an accidental fire occur. Fire extinguishers are located on all equipment.

j. Contingency Planning

Emergency Response Plan

The new transmission line will create a redundancy in the Joint Powers Water Board's system and is therefore not critical to the supply of water to the system. The Board will have a schedule of inspection for the line and pump station and will address any issues that may arise.

10. Termination and Restoration

a. Removal of Structures

No structures will be removed with this project on BLM property

b. Will pipe be removed or cleaned and left in ground

At the end of pipe's useful life, it will be left in place.

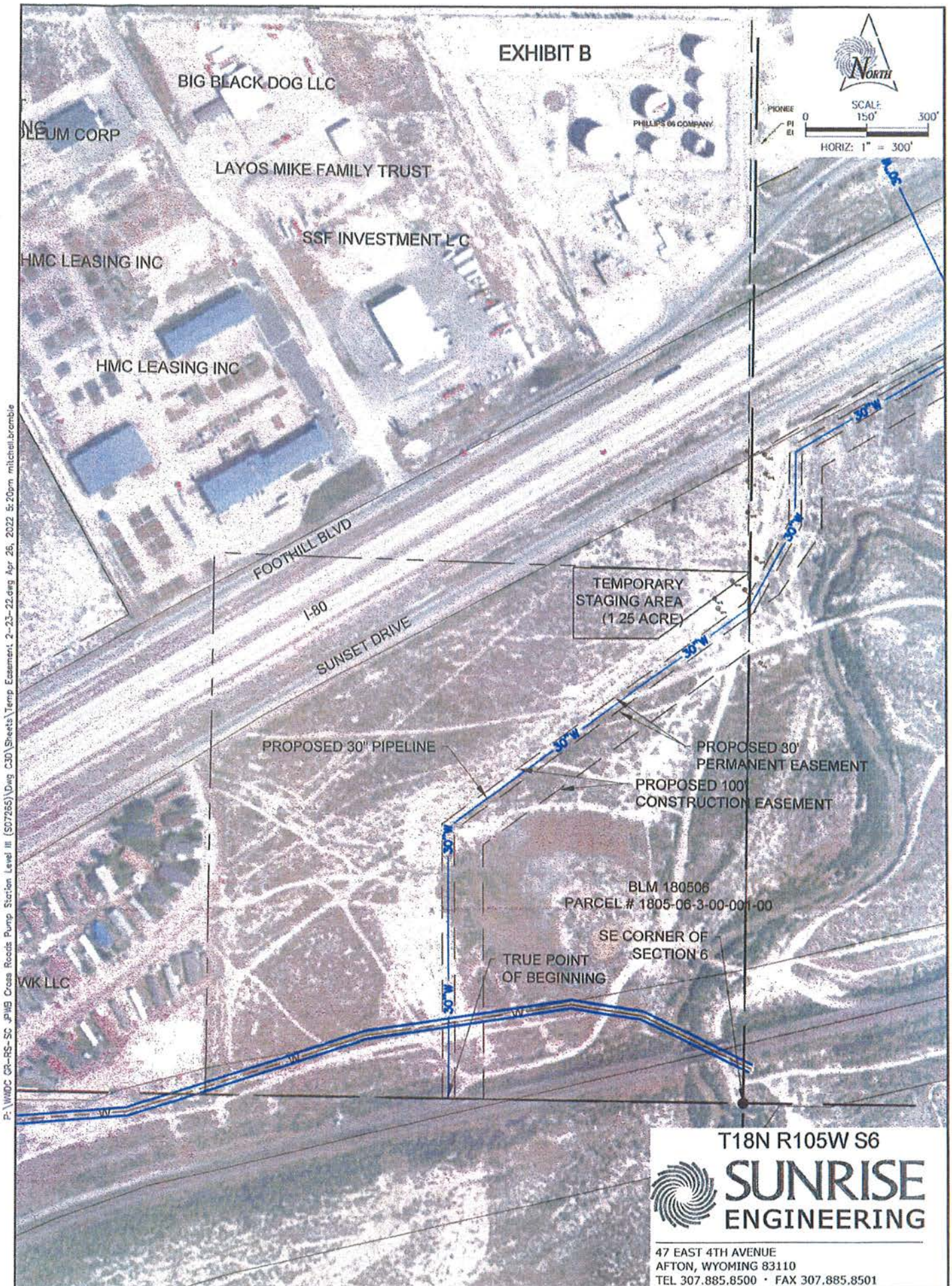
c. Obliteration of roads

N/A

d. Stabilization and re-vegetation of disturbed areas

Any disturbed areas will be recontoured.

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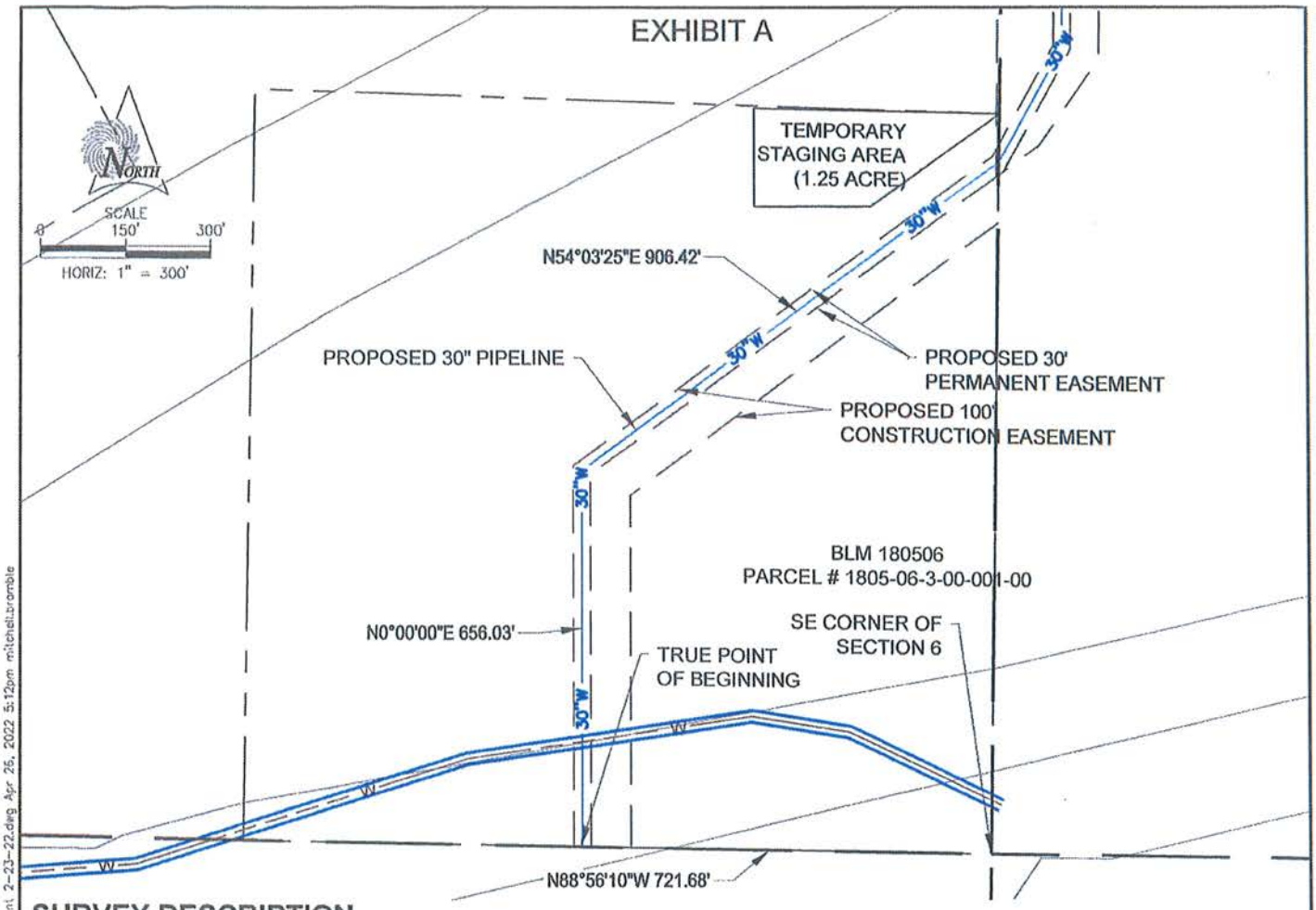


SUNRISE ENGINEERING
47 EAST 4TH AVENUE
AFTON, WYOMING 83110
TEL 307.885.8500 · FAX 307.885.8501
www.sunrise-eng.com

EXHIBIT B

P:\WMDC GR-RS-SC JPWB Cross Roads Pump Station Level III (507265)\Dwg C3D\Sheets\Temp Easement 2-23-22.dwg Apr 26, 2022 5:26pm mitchell.brambie

EXHIBIT A



SURVEY DESCRIPTION

A STRIP OF LAND 30 FEET WIDE, 15 FEET ON EITHER SIDE OF THE FOLLOWING DESCRIBED CENTERLINE:

BEGINNING AT THE SOUTHEAST CORNER OF SECTION 6, TOWNSHIP 18 NORTH, RANGE 105 WEST, SIXTH PRINCIPAL MERIDIAN, SWEETWATER COUNTY, WYOMING; THENCE N88°56'10"W, 721.68 FEET, TO THE TRUE POINT OF BEGINNING. THENCE N00°00'00"E, 656.03 FEET, THENCE N54°03'25"E, 906.42 FEET TO THE POINT OF ENDING.

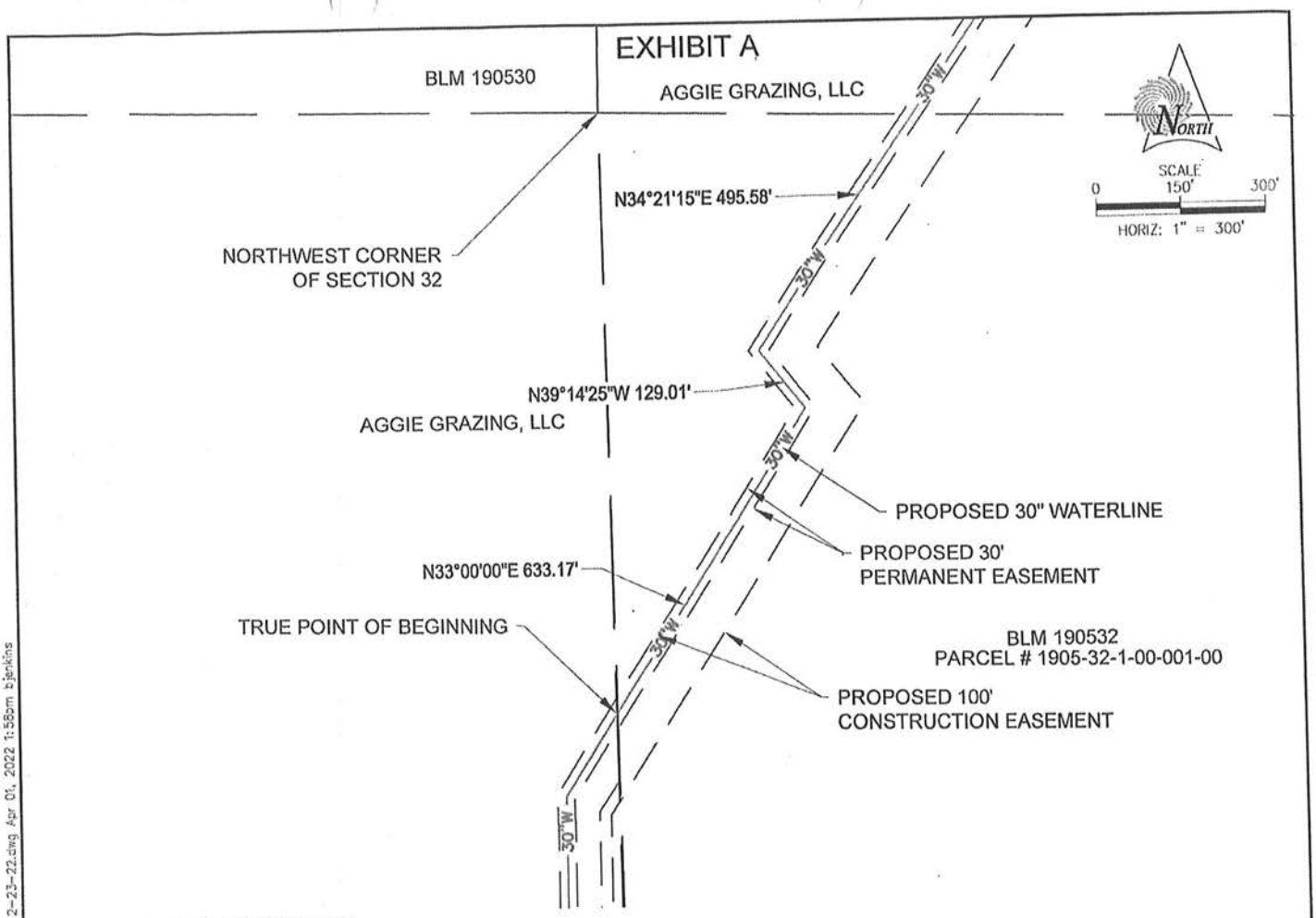
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EXHIBIT FOR EXCLUSIVE
EASEMENT FOR WATERLINE

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AFTON, WYOMING 83110
TEL 307.885.8500 • FAX 307.885.8501
www.sunrise-eng.com

EXHIBIT C

P:\WWDC GR-RS-SC JPWG Cross Roads Pump Station Level III (507265)\Dwg C3D\Sheets\Temp Easement 2-23-22.dwg Apr 26, 2022 5:12pm mitchell.bramble



SURVEY DESCRIPTION

A STRIP OF LAND 30 FEET IN WIDTH, 15 FEET ON EITHER SIDE OF THE FOLLOWING DESCRIBED CENTERLINE:

BEGINNING AT THE NORTHWEST CORNER OF SECTION 32, TOWNSHIP 19 NORTH, RANGE 105 WEST, SIXTH PRINCIPAL MERIDIAN, SWEETWATER COUNTY, WYOMING; THENCE S00°35'53"E, 1053.72 FEET,TO THE TRUE POINT OF BEGINNING. THENCE N33°00'00"E, 633.17 FEET, THENCE N39°14'25"W, 129.01 FEET, THENCE N34°21'15"E, 495.58 FEET, TO THE POINT OF ENDING.

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EXHIBIT D

P:\WWDC CR-RS-SC JPWB Cross Roads Pump Station Level III (507265)\Dwg C3D\Sheets\Temp Easement 2-23-22.dwg Apr 01, 2022 1:58pm bjenkins

KINDER MORGAN

September 29, 2025

GR-RS-SC Joint Powers Water Board
Attn: Bryan Seppie
PO Box 1299
Green River, WY 82935

ENCROACHMENT
STIPULATION LETTER

RE: Access road and 30 inch pipeline crossing Colorado Interstate Gas Company's pipeline

Tract: 5A = 753

County: Sweetwater

State: WY

Dear Mr. Seppie,

Colorado Interstate Gas Company ("Company") hereby acknowledges the receipt of that certain email from Sunrise Engineering with the reference or subject line of "Re: Colorado Interstate Gas Company – Encroachment Information Form" from Dave Kennington representing GR-RS-SC Joint Powers Water Board ("Water Board") dated February 26, 2024 and information updated via an email titled "Crossroads Pump Station Access Road" from Dave Kennington on September 26, 2025 including the plan attached thereto entitled "Crossroads Pump Station Access Road Plan and Profile" which are together marked as Exhibit "A" and attached hereto and made a part hereof and hereinafter referred to as the "Encroachment". Said plan shows, describes, details, and/or depicts the proposed methods and specifications for the installation/construction of an access road and a 30 inch diameter steel water pipe upon, over, under, within, or in close proximity to Company's pipeline and/or pipeline related facilities ("Company Facilities") on Company's easement or easements (whether one or more, "Company Easement") referenced by the tract number(s) above.

Company hereby grants approval of the plans and work referenced in Exhibit "A" attached hereto and made a part hereof, provided:

1. This letter is countersigned and a copy is returned to Company at the address listed below prior to commencement of any construction activity within the confines of the Company Easement. If this letter is not signed and returned to Company, Company's consent herein shall be withdrawn; no work will be authorized within the confines of the Company Easement.

2. The following conditions are observed:

   a. All work must comply with the plans referenced herein and attached hereto. Any changes to the design and/or construction must be pre-approved in advance by Company.

   b. Except as specifically set forth in Exhibit "A", Water Board shall construct, own, operate, maintain, use and remove the Encroachment in accordance with Company's O&M Procedure 204 OM200-29 titled "Guidelines for Design and Construction near Kinder Morgan Operated Facilities," which is attached hereto as Exhibit "B" and made a part hereof. **A Company representative shall be on-site to monitor any construction activities within twenty-five (25) feet of Company Facilities or within the Company Easement.**

c. At least five (5) business days prior to any work on or near Company Facilities and/or within the Company Easement, Water Board, its contractor(s), subcontractor(s), and/or developer(s) must call Company's Bucky Moore, Damage Prevention Supervisor, at (435-823-8233). He will arrange to have a Company representative on-site while work is occurring.

d. Company requires that each contractor or subcontract associated with the Encroachment submit a Wyoming One Call (8-1-1) Ticket for each different phase of the Encroachment that involves earth disturbance (grading, excavating, trenching, digging, etc.).

e. Water Board shall be solely responsible for the construction, ownership, operation, maintenance, use, and removal of the Encroachment and for any and all expenses including inspection fees incurred by Company and/or damage to Company Facilities and/or the Company Easement as a result of, in the Company's sole opinion, the Water Board's activities upon the Company Easement. Water Board shall, upon demand by Company, reimburse Company fully for any such expense or damage. Water Board agrees to indemnify and hold harmless Company, its parent, affiliates, agents, employees, contractors, and subcontractors and their respective successors and assigns (individually and collectively, the "Company Indemnitees"), against any claim, demand, or cause of action of any party (including, but not limited to reasonable attorney's fees) in any way arising from or related to (1) the existence of the Encroachment, (2) Water Board's approved activities under this Stipulation Letter, (3) Water Board's breach of its obligations under this Stipulation Letter, or (4) any cause of action resulting from damage to Company Facilities or the Company Easement by Water Board, its parent, affiliates, agents, employees, contractors or subcontractors.

f. During the term of this Agreement, Water Board shall carry and maintain, and shall cause its contractors to carry and maintain the following insurance from carriers with an A.M. Best rating of not less than A-/VII:

    a. Statutory Coverage Workers' Compensation Insurance (including Occupational Disease Coverage) in accordance with the laws of the states where the work is to be performed.

    b. Employer's Liability Insurance with limits of not less than $1,000,000 per occurrence and $1,000,000 per disease/each employee.

    c. Commercial General Liability Insurance insuring the indemnity provisions set forth in this Agreement with a combined single limit of not less than $5,000,000 per occurrence and $5,000,000 in the aggregate. All policies shall remove any exclusion for explosion, collapse and underground operations (XCU), sudden and accidental pollution and include coverage for blanket contractual liability assumed hereunder.

    d. Comprehensive Automobile Liability Insurance covering liability arising out of any auto (owned, hired and non-owned); with a combined single limit of not less than $1,000,000.

    e. Umbrella/Excess Liability Insurance with a minimum limit of not less than $5,000,000 per occurrence. Such umbrella policy shall follow the form of the Employer's Liability Insurance, Commercial General Liability Insurance and Business Automobile Liability Insurance set out above, be in excess of those underlying policies without gaps in limits and provide coverage as broad as those underlying policies.

All insurance policies of Water Board shall include a waiver of subrogation in favor of Company and each of its respective subsidiary or affiliated companies and entities, and shall name Company and each of its respective subsidiary or affiliated companies and entities, and their respective directors,

officers, agents and employees as additional insureds (except for Workers' Compensation). All such insurance coverages required of Water Board shall apply as primary insurance with respect to any other insurance or self-insurance programs afforded to or maintained by or for the benefit of Company. Prior to beginning any operations under this Agreement, Water Board shall furnish Company with certificates of insurance evidencing insurance coverage and provisions provided for in this Agreement. Notwithstanding the foregoing, Water Board may self-insure to meet the insurance requirements of this Section. If Water Board elects to self-insure any of the requirements above, Water Board's self-insurance program shall respond in the same manner as commercial insurance with regard to additional insured and waiver of subrogation.

g. The review and approval of this proposal shall only be valid for a period of one (1) year from the date of this letter.

h. All of the terms and conditions of the Company Easement shall remain in full force and effect.

i. The permission granted herein shall not be assignable, in whole or in part, without Company's express written consent.

j. This Stipulation Letter shall be binding upon and inure to the benefit of the parties hereto, including Water Board's contractors, subcontractors, and developers, if any.

If you have any questions, please contact me by telephone at (719) 659-5936, by e-mail at steve_bacon@kindermorgan.com, or by mail at: Kinder Morgan, Inc., c/o Colorado Interstate Gas Company, Attn: Steve Bacon – Land Dept., 2 N. Nevada Ave., Colorado Springs, CO 80903.

COUNTERSIGNED AND AGREED TO:

Bryan Seppie
Signature

Bryan Seppie
Name

GR/RS/SwCo. - JPWB
Company

11/5/25
Date

Sincerely,

Stephen Bacon

Stephen Bacon
Sr. ROW Agent II
Colorado Interstate Gas Company, L.L.C.

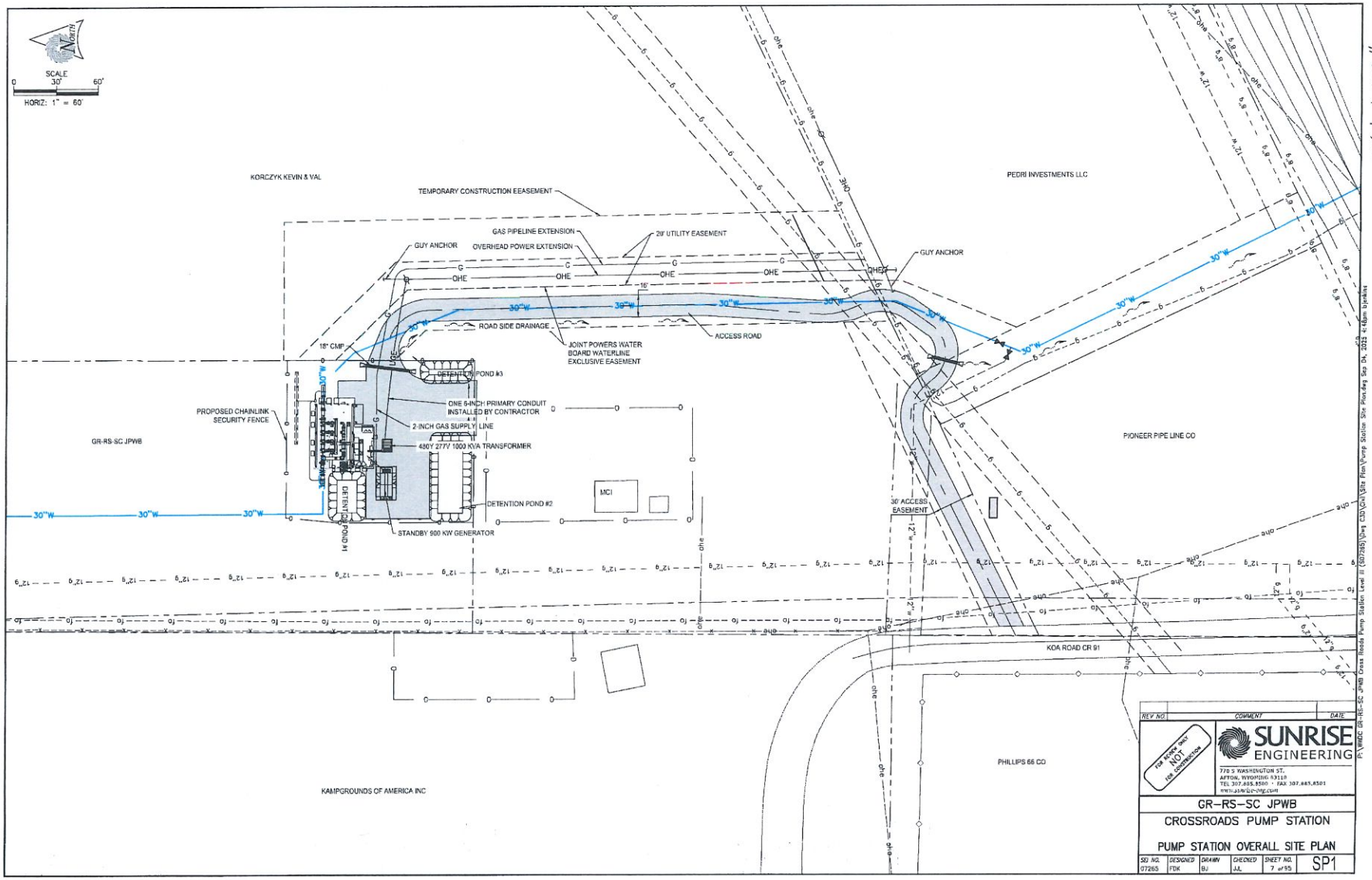
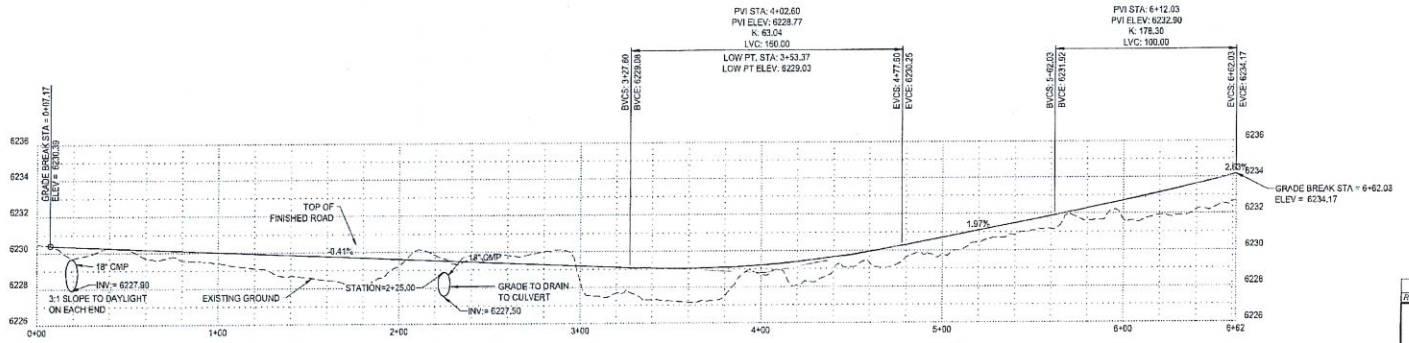
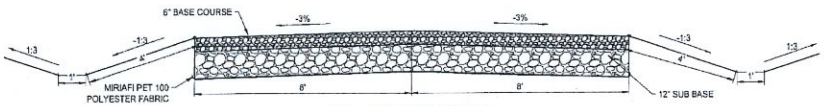

SCALE
0 30' 60'
HORIZ: 1" = 60'
KORCZYK KEVIN & VAL
TEMPORARY CONSTRUCTION EASEMENT
GAS PIPELINE EXTENSION
OVERHEAD POWER EXTENSION
20' UTILITY EASEMENT
GUY ANCHOR
PEDRI INVESTMENTS LLC
ROAD SIDE DRAINAGE
JOINT POWERS WATER BOARD WATERLINE EXCLUSIVE EASEMENT
ACCESS ROAD
18" CMP
DETENTION POND #3
PROPOSED CHAINLINK SECURITY FENCE
ONE 6-INCH PRIMARY CONDUIT INSTALLED BY CONTRACTOR
2-INCH GAS SUPPLY LINE
GR-RS-SC JPWB
480Y 277/ 1000 KVA TRANSFORMER
PIONEER PIPE LINE CO
DETENTION POND #1
DETENTION POND #2
MCI
30' ACCESS EASEMENT
STANDBY 900 KW GENERATOR
KOA ROAD CR 91
PHILLIPS 66 CO
KAMPGROUNDS OF AMERICA INC
REV NO. COMMENT DATE
FOR REVIEW ONLY NOT FOR CONSTRUCTION
SUNRISE ENGINEERING
770 S WASHINGTON ST.
AFTON, WYOMING 83110
TEL 307.885.8500 • FAX 307.885.8501
GR-RS-SC JPWB
CROSSROADS PUMP STATION
PUMP STATION OVERALL SITE PLAN
SD NO. 07265
DESIGNED FDK
DRAWN BJ
CHECKED JJL
SHEET NO. 7 of 55
SP1

Exhibit "A"

Exhibit "A"







B ACCESS ROAD
NOT TO SCALE SECTION VIEW

North

SCALE
0 30' 60'
HORIZ: 1" = 60'

811 Know what's below. Call before you dig. 1-800-849-2476

REV NO.	COMMENT	DATE

FOR REVIEW ONLY NOT FOR CONSTRUCTION

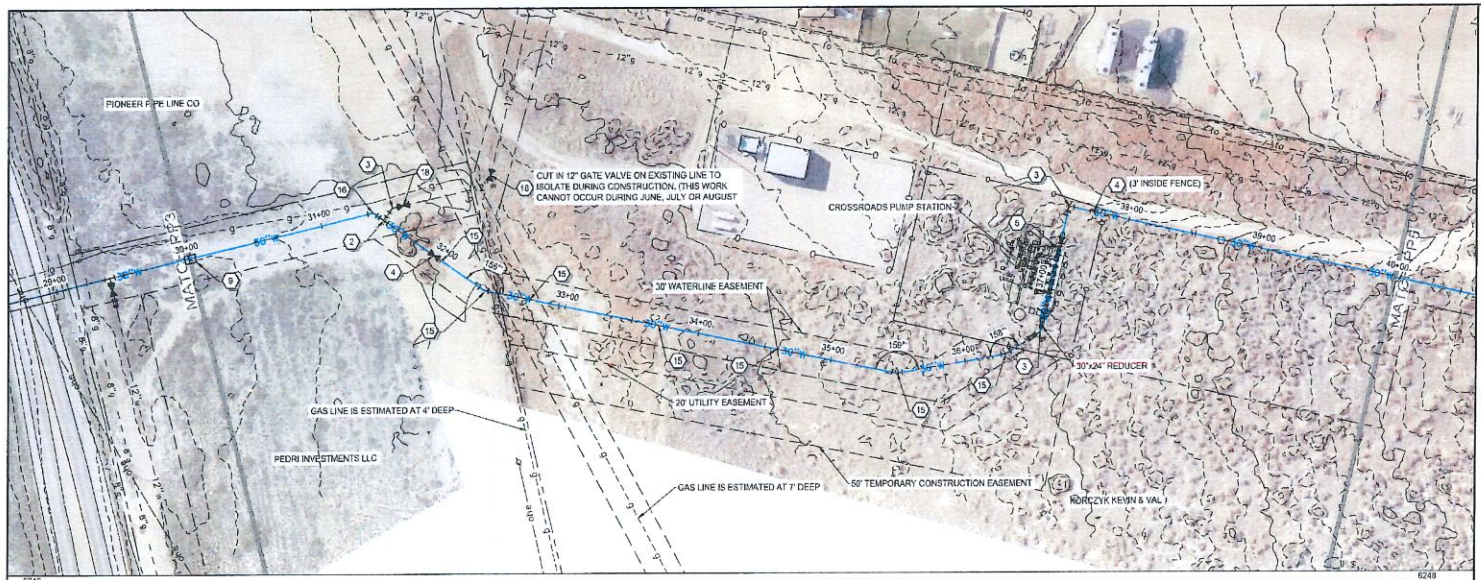
SUNRISE ENGINEERING
770 S WASHINGTON ST.
AFTON, WYOMING 83110
TEL 307.885.8309 · FAX 307.885.8501
www.sunrise-eng.com

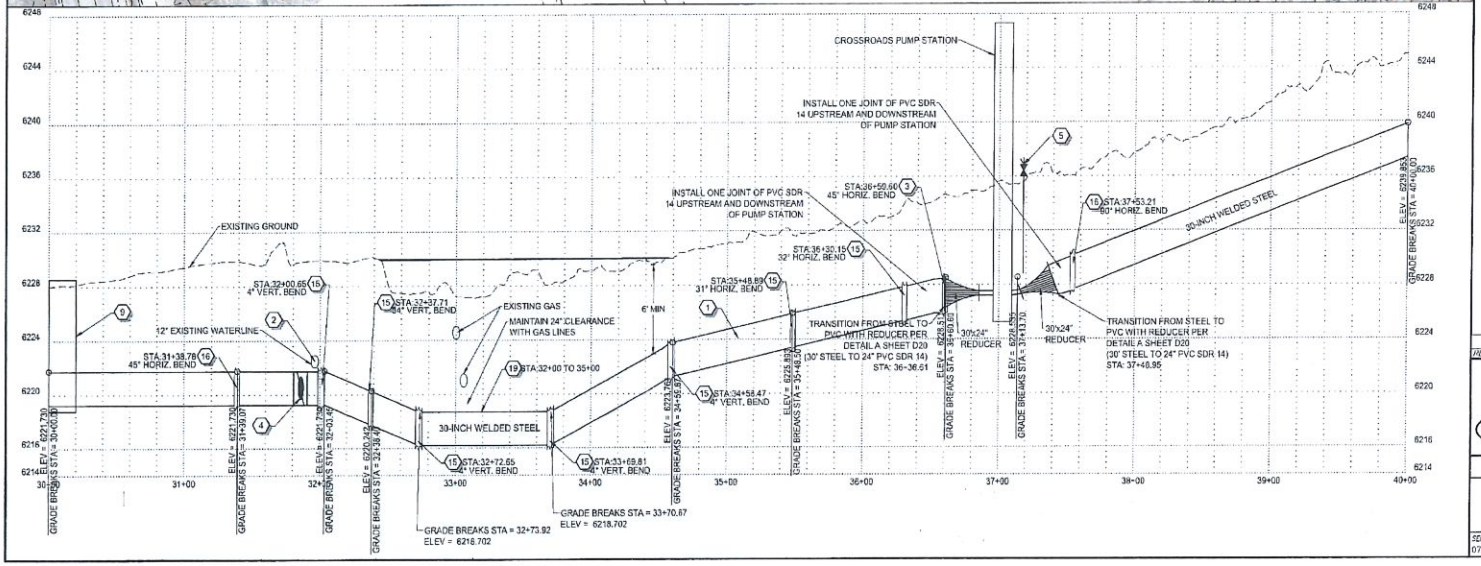
GR–RS–SC JPWB

CROSSROADS PUMP STATION
ACCESS ROAD
PLAN AND PROFILE

SO NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
07255	FDK	BJ	JJL	11 of 55	RP

P:\WWDC GR-RS-SC JPWB Cross Roads Pump Station Levee @ (307)\Civil\Site Plan\Access Road.dwg Sep 04, 2025 4:48pm bjensen





WATERLINE NOTES:

1. NEW 30" WATERLINE PER A/D01, A/E01
2. CONNECT TO EXISTING 12" WATERLINE PER C/D01, D/D15, E/D01
3. BEND (90°, 45°, 22 1/2°, ETC.) WITH THRUST BLOCK. A/D01
4. BUTTERLY VALVE PER A/D01
5. BLOWOFF ASSEMBLY PER C/D01
6. TEE WITH THRUST BLOCK PER A/D01
7. CONNECT TO EXISTING 20" WATERLINE PER A/D01
8. MANWAY WITH AIRVAC PER A/D01, C/D18
9. MANWAY WITH AIR RELEASE PER A/D01, C/D17
10. MANWAY PER A/D01, A/D02
11. AIRVAC VALVE PER C/D17
12. EPHEMERAL WASH CROSSING PER A/D01
13. CONNECT TO EXISTING 18" WATERLINE PER A/D01
14. CLAY CUT-OFF WALL PER A/D01
15. 2-PIECE BEND WITH THRUST BLOCK A/D01
16. 3-PIECE BEND WITH THRUST BLOCK A/D01
17. JIM BRIDGER PIPELINE CROSSING A/D01, B/D01
18. GATE VALVE PER DETAIL D/D01
19. WEAK SOILS CROSSING E/D01
20. CONCRETE PIPELINE ANCHOR D/D13
21. 30"x12" CROSS WITH THRUST BLOCK PER A/D01
22. CHECK VALVE VAULT A/D01, E/D01, A/D18
23. EROSION BLANKET PER E/D13, E/D15
24. SEDIMENT LOG/WATTLE PER A/D01, B/D15
25. FIRE HYDRANT PER F/D01

SCALE
0 40' 80'
HORIZ: 1" = 80'

811 Know what's below. Call before you dig. 1-800-849-2476

INI'L NO	COMMENT	DATE

FOR REVIEW ONLY NOT FOR CONSTRUCTION

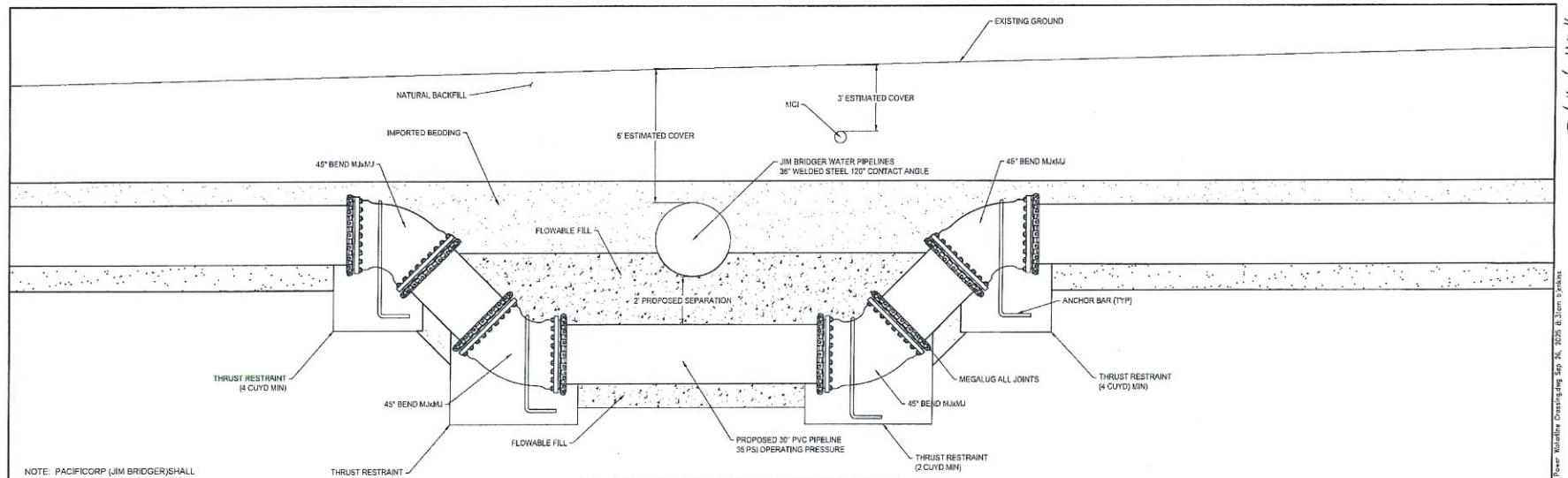
SUNRISE ENGINEERING
779 S WASHINGTON ST.
AFTON, WYOMING 83110
TEL 307.885.8500 • FAX 307.885.8501
www.sunrise-eng.com

GR-RS-SC JPWB
CROSSROADS PUMP STATION
PLAN AND PROFILE

SD NO	DESIGNED	DRAWN	CHECKED	SHEET NO.	
07265	FDK	BJ	JJL	19 of 35	PP4

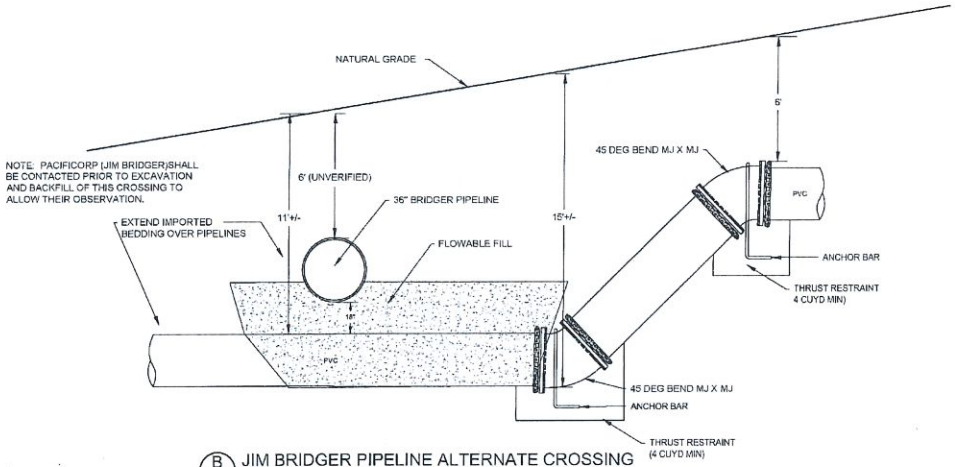
P:\WMC GR-RS-SC JPWB Cross Roads Pump Station Level B (07265)\Proj CAD\Sheets\Plan & Profile1.dwg Sep 24, 2025 4:59pm bjohnson

Exhibit "A"

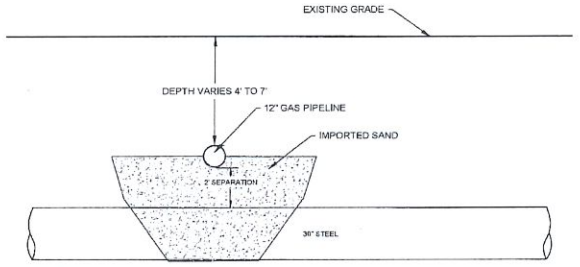


NOTE: PACIFICORP (JIM BRIDGER)SHALL BE CONTACTED PRIOR TO EXCAVATION AND BACKFILL OF THIS CROSSING TO ALLOW THEIR OBSERVATION.

A ~ JIM BRIDGER PIPELINE CROSSING STA: 111+37
DETAIL



B ~ JIM BRIDGER PIPELINE ALTERNATE CROSSING
NOT TO SCALE SECTION VIEW



NOTE: KINDER MORGAN SHALL BE CONTACTED PRIOR TO EXCAVATION AND BACKFILL OF THIS CROSSING TO ALLOW THEIR OBSERVATION.

C ~ GAS PIPELINE CROSSINGS
NOT TO SCALE SECTION VIEW

REV NO.	COMMENT	DATE

FOR REVIEW ONLY NOT FOR CONSTRUCTION

SUNRISE ENGINEERING
770 S WASHINGTON ST.
AFTON, WYOMING 83110
TEL 307.885.8500 - FAX 307.885.8501
www.sunrise-eng.com

GR–RS–SC JPWB

CROSSROADS PUMP STATION
JIM BRIDGER PIPELINE CROSSING
DETAILS

SCI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
07265	FDK	BJ	JJL	81 of 95	D7

P:\WDOC GR-RS-SC JPWB Cross Roads Pump Station Level III (507265)\Dwg CSD\Civil\Waterline\Details\Pacific Power Rotaflex Crossing.dwg Sep 26, 2025 8:31am bjenkins

KINDER MORGAN

Guidelines for Design and Construction near Kinder Morgan Operated Facilities

Name of Company: Colorado Interstate Gas Company, L.L.C. ("CIG")

The list of design, construction and contractor requirements, including but not limited to the following, for the design and installation of foreign utilities or improvements on **CIG** (Company) right-of-way (ROW) are not intended nor do they waive or modify any rights Company may have under existing easements or ROW agreements. Reference existing easements and amendments for additional requirements. This list of requirements is applicable for Company facilities on easements only. Encroachments on fee property should be referred to the Land and Right-of-Way Department.

Design

- Company shall be provided sufficient prior notice of planned activities involving excavation, blasting, or any type of construction on Company's ROW to determine and resolve any location, grade or encroachment problems and provide protection of our facilities and the public before the actual work is to take place.
- Encroaching entity shall provide Company with a set of drawings for review and a set of final construction drawings showing all aspects of the proposed facilities in the vicinity of Company's ROW. The encroaching entity shall also provide a set of as-built drawings showing the proposed facilities in the vicinity of Company's ROW.
- Only facilities shown on drawings reviewed by Company will be approved for installation on Company's ROW. All drawing revisions that effect facilities proposed to be placed on Company's ROW must be approved by Company in writing.
- Company shall approve the design of all permanent road crossings.
- Encroaching entity shall, at the discretion of the Company, incorporate Heath ATI "sniffer" Gas Detection Units in the design of paved areas or "Green Belt" areas of Company ROW. The units shall be installed per Company Standard **TYP-V-0100-B010 – Gas Detection Unit for Pipelines Located under Asphalt or Concrete Parking Areas**.
- Any repair to surface facilities following future pipeline maintenance or repair work by Company will be at the expense of the developer or landowner.
- The depth of cover over the Company pipelines shall not be reduced nor drainage altered without Company's written approval.
- Construction of any permanent structure, building(s) or obstructions within Company pipeline easement is not permitted.
- Planting of shrubs and trees is not permitted on Company pipeline easement.
- Irrigation equipment i.e. backflow prevent devices, meters, valves, valve boxes, etc. shall not be located on Company easement.
- Foreign line, gas, water, electric and sewer lines, etc., may cross perpendicular to Company's pipeline within the ROW, provided that a minimum of two (2) feet of vertical clearance is maintained between Company pipeline(s) and the foreign pipeline. Constant line elevations must be maintained across Company's entire ROW width, gravity drain lines are the only exception. Foreign line crossings below the Company pipeline must be evaluated by Company to ensure that a significant length of the Company line is not exposed and unsupported during construction. When installing underground utilities, the last line should be placed beneath all existing lines unless it is impractical or unreasonable to do so. Foreign line crossings above the Company pipeline with less than two (2) feet of clearance must be evaluated by Company to ensure that additional support is not necessary to prevent settling on top of the Company natural gas pipeline.
- A foreign pipeline shall cross Company facilities at as near a ninety-degree angle as possible. A foreign pipeline shall not run parallel to Company pipeline within Company easement without written permission of Company.
- The foreign utility should be advised that Company maintains cathodic protection on their pipelines. The foreign utility must coordinate their cathodic protection system with Company's. At the request of Company, foreign utilities shall install (or allow to be installed) cathodic protection test leads at all crossings for the purposes of monitoring cathodic protection. The Company Cathodic Protection (CP) technician and the foreign utility CP technician shall perform post construction CP interference testing. Interference issues shall be resolved by mutual agreement between foreign utility and Company. All costs associated with the correction of cathodic protection problems on Company pipeline as a result of the foreign utility crossing shall be borne by the foreign utility for a period of one year from date the foreign utility is put in service.

- The metallic foreign line shall be coated with a suitable pipe coating for a distance of at least 10-feet on either side of the crossing unless otherwise requested by the Company CP Technician.
- AC Electrical lines must be installed in conduit and properly insulated.
- DOT approved pipeline markers shall be installed so as to indicate the route of the foreign pipeline across the Company ROW.
- No power poles, light standards, etc. shall be installed on Company easement.

Construction

- Contractors shall be advised of Company's requirements and be contractually obligated to comply.
- The continued integrity of Company's pipelines and the safety of all individuals in the area of proposed work near Company's facilities are of the utmost importance. Therefore, contractor must meet with Company representatives prior to construction to provide and receive notification listings for appropriate area operations and emergency personnel. **Company's on-site representative will require discontinuation of any work that, in his opinion, endangers the operations or safety of personnel, pipelines or facilities.**
- The Contractor must expose all Company transmission and distribution lines prior to crossing to determine the exact alignment and depth of the lines. A Company representative must be present. In the event of parallel lines, only one pipeline can be exposed at a time.
- Company will not allow pipelines to remain exposed overnight without consent of Company designated representative. Contractor may be required to backfill pipelines at the end of each day.
- A Company representative shall do all line locating. A Company representative shall be present for hydraulic excavation. The use of probing rods for pipeline locating shall be performed by Company representatives only, to prevent unnecessary damage to the pipeline coating.
- Notification shall be given to Company at least 72 hours before start of construction. A schedule of activities for the duration of the project must be made available at that time to facilitate the scheduling of Company's work site representative. Any Contractor schedule changes shall be provided to Company immediately.
- Heavy equipment will not be allowed to operate directly over Company pipelines or in Company ROW unless written approval is obtained from Company. Heavy equipment shall only be allowed to cross Company pipelines at locations designated by Company. Contractor shall comply with all precautionary measures required by Company to protect its pipelines. When inclement weather exists, provisions must be made to compensate for soil displacement due to subsidence of tires.
- Excavating or grading which might result in erosion or which could render the Company ROW inaccessible shall not be permitted unless the contractor/developer/owner agrees to restore the area to its original condition and provide protection to Company's facility.
- A Company representative shall be on-site to monitor any construction activities within 25-feet of a Company pipeline or aboveground appurtenance. The contractor **shall not** work within this distance without a Company representative being on site. Only hand excavation shall be permitted within a minimum of 18-inches (refer to state specific rules/regulations regarding any additional clearance requirements) of Company pipelines, valves and fittings. However, proceed with extreme caution when within three (3) feet of the pipe.
- Ripping is only allowed when the position of the pipe is known and not within 10-feet of Company facility unless Company representative is present.
- Temporary support of any exposed Company pipeline by Contractor may be necessary if required by Company's on-site representative. Backfill below the exposed lines and 12-inches above the lines shall be replaced with sand or other selected material as approved by Company's on-site representative and thoroughly compacted in 12-inches lifts to 95% of standard proctor dry density minimum or as approved by Company's on-site representative. This is to adequately protect against stresses that may be caused by the settling of the pipeline.

Exhibit "B" 2-3

KINDER MORGAN

Guidelines for Design and Construction near Kinder Morgan Operated Facilities

- No blasting shall be allowed within 1000-feet of Company's facilities unless blasting notification is given to Company including complete Blasting Plan Data. A pre-blast meeting shall be conducted by the organization responsible for blasting.

  Company shall be indemnified and held harmless from any loss, cost of liability for personal injuries received, death caused or property damage suffered or sustained by any person resulting from any blasting operations undertaken within 500-feet of its facilities. The organization responsible for blasting shall be liable for any and all damages caused to Company's facilities as a result of their activities whether or not Company representatives are present. Company shall have a signed and executed Blasting Indemnification Agreement before authorized permission to blast can be given.

  No blasting shall be allowed within 300-feet of Company's facilities unless blasting notification is given to Company a minimum of one week before blasting. *(Note: covered above)* Company shall review and analyze the blasting methods. A written blasting plan shall be provided by the organization responsible for blasting and agreed to in writing by Company in addition to meeting requirements for 500-feet and 1000-feet being met above. A written emergency plan shall be provided by the organization responsible for blasting. *(Note: covered above)*

- **Any** contact with any Company facility, pipeline, valve set, etc. shall be reported immediately to Company. If repairs to the pipe are necessary, they will be made and inspected before the section is re-coated and the line is back-filled.

- Company personnel shall install all test leads on Company facilities.

- Burning of trash, brush, etc. is not permitted within the Company ROW.

Exhibit "B" 3-3

KINDER MORGAN Clear Form

Encroachment Information Form

SECTION 1 - Encroaching Party Contact Information

Name/Company	Contact Name	Title	
GR-RS-SC Joint Powers Water Board	Bryan Seppie, P.E.	General Manager	
Address	**City**	**State**	**Zip Code**
P.O. Box 1299	Green River	WY	82935
Telephone	**Fax Number**	**Cellular Number**	**Email Address**
307 875 4317			bseppie@jpwb.org
Representative (contractor/consultant) Name	**Contact Name**	**Title**	
Sunrise Engineering, Inc.	David Kennington, P.E.	Project Engineer	
Address	**City**	**State**	**Zip Code**
770 S Washington Ste. A	Afton	WY	83110
Telephone	**Fax Number**	**Cellular Number**	**Email Address**
307 885 8500	307 885 8501	307 248 0160	dkennington@sunrise-eng.com

Landowner Name (if not applicant): Korczyk, Kevin C and Valerie M & Scheer Properties

Landowner consent to works obtained? ☑ Yes ☐ No

Location of Encroachment (e.g. city, county, state road/street or legal description of property)

1805-05-2-00-013-00

Section:	Township:	Range:	Coordinates: GPS (Nad 83)
5	18N	105W	Lat (y): 41.568110° Long (x): -109.290555°

The signatory is seeking to construct facilities or operate equipment under, over, near or crossing Kinder Morgan facilities or within the limits of the right-of-way under the jurisdiction of Kinder Morgan in accordance with applicable government regulations. The proposed encroachment is as follows:

Description of Encroachment and the construction procedures to be followed (attach extra pages as required to give full description)

Encroachment will be for the construction and operation of an 30-inch welded steel pipeline providing suction supply to a pump station located north of the encroachment. The pipe will be installed by open trench methods and cross under the Kinder Morgan facility with a clearance of at least two feet.

Tentative construction date (MM/DD/YY)

SECTION 2 - Proposed Encroachment Type (check all that apply)

☐ 1. Roadway Improvement / Widening	☐ 8. Drainage Channel Improvements	☐ 15. Fence / Landscape
☐ 2. New Paved Roadway / Parking Lot	☐ 9. Drainage Line (Storm Sewer)	☐ 16. Below Grade Elec. / Comm.
☑ 3. Unpaved Roadway / Gravel Roadway	☑ 10. Utility Line (Water/Sanitary)	☐ 17. Aerial Elect. / Comm.
☐ 4. Driveway / Parking Lot / Sidewalk	☐ 11. Foreign Pipeline	☐ 18. Seismic / Vibration
☐ 5. Railway Crossing	☐ 12. Dredging	☐ 19. Pile Driving
☐ 6. Grading / Add Fill / Remove Fill	☐ 13. Heavy Equipment Crossing	☐ 20. Blasting
☐ 7. Structure (walls, footings, buildings, etc.)	☐ 14. Waterway Crossing	☐ 21. Other:

SECTION 3 - Required Information for Encroachment Review

Drawing and Information Types: DOC = Depth of Cover

- ☐ 1. Plan drawings. **Kinder Morgan pipeline(s) shall be indicated with DOC.**
- ☑ 2. Plan and profile (cross section) drawings with cover sheet. **Kinder Morgan pipeline(s) shall be indicated with DOC.**
- ☐ 3. Grading Plan - Indicate slope, contours, drainage/water flow changes, swales and erosion control.
- ☐ 4. Dredging Plan - Include the dredge outline showing depth and width of dredge limits. Specify dredge equipment and method.
- ☐ 5. Equipment Vehicle Specifications - Complete SECTION 5
- ☐ 6. Equipment Vibratory Specifications
- ☐ 7. Explosive Specifications
- ☐ 8. At minimum provide Plan drawings. If encroachment goes below grade provide profile drawing with DOC.
- ☑ 9. Complete SECTION 4 for items 9, 10 and 11 of SECTION 2

SECTION 4 - Utility & Foreign Line Crossings

A. Installation Method (Check all that apply): ☑ Conventional (open cut method) ☐ Bore (Auger Bore / Jack & Bore) ☐ HDD (Horizontal Directional Drill) ☐ Tunneling

B. Crossing Type (Check all that apply): ☑ Crossing OVER KM Pipeline ☑ Crossing UNDER KM Pipeline

C. Does each crossing have an angle close to 90°? ☑ Yes ☑ No

D. The newest crossings should be installed below existing facilities outside the tolerance zone. ☑ Yes ☐ No ☐ TBD
Does the new crossing meet the clearance & cover requirements outlined in the KM Developer Handbook?

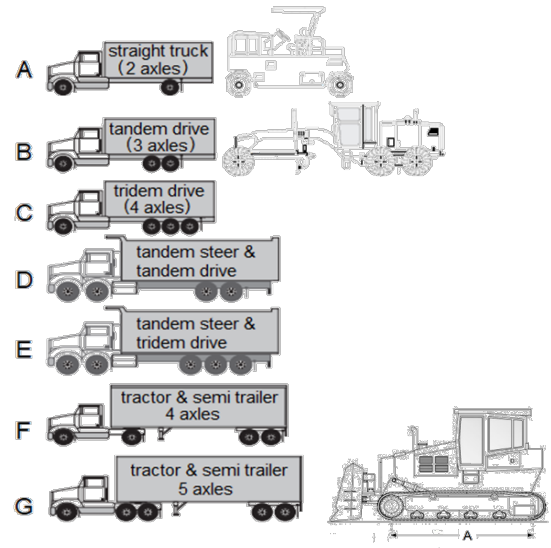
KINDER MORGAN **Clear Form**

Encroachment Information Form

SECTION 5 - Vehicle Crossing Data

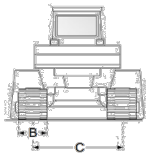
Lat, Lon	41.567918°, -109.290780° and 41.568037°-109.290633°	One Call Ticket #	
Address	-109.290780°	DOC Determination	☐ Pothole ☐ Probe ☐ Locator
Soil Type	☑ Granular Material ☑ Sand & Gravel ☐ Saturated Clay ☐ Saturated Top Soil ☐ Clay	Pavement Material	☑ No Pavement ☐ Asphalt ☐ Concrete

	Pipe 1	Pipe 2	Pipe 3	Pipe 4
Depth of Cover	8-9 ft	ft	ft	ft
Pavement Thickness	in	in	in	in
OD	30 in	in	in	in



	Make	Model	Weight	Axle Configuration
Axle Vehicle 1			lb	
Axle Vehicle 2			lb	
Axle Vehicle 3			lb	
Axle Vehicle 4			lb	

	Make	Model	Weight	A Track Length	B Track Width	C Track Gauge
Track Vehicle 1			lb	ft	in	ft
Track Vehicle 2			lb	ft	in	ft
Track Vehicle 3			lb	ft	in	ft
Track Vehicle 4			lb	ft	in	ft



SECTION 5 - Signature

Work shall not commence until reviewed by Kinder Morgan. The facilities or equipment must be constructed in accordance with the guidelines provided by Kinder Morgan.

Name (Print) _____ Date (MM/DD/YY) _____ Signature _____

Kinder Morgan operates pipeline facilities nationwide. Send completed requests with required supplemental information to the appropriate regional mailbox where your project will take place:

KMEncroachmentsNorth@kindermorgan.com
Pennsylvania, New York, New Jersey, Rhode Island, Connecticut, New Hampshire and Massachusetts

KMEncroachmentsCentral@kindermorgan.com
Montana, North Dakota, South Dakota, Minnesota, Iowa, Nebraska, Kansas, Missouri, Illinois, Indiana and Arkansas

KMEncroachmentsSouth@kindermorgan.com
Delaware, District of Columbia, Virginia, North Carolina, South Carolina, Georgia, Alabama and Florida

KMEncroachmentsPacific@kindermorgan.com
California, Oregon and Washington

KMEncroachmentsGulf@kindermorgan.com
Oklahoma, Texas, Louisiana and Mississippi

KMEncroachmentsWest@kindermorgan.com
Wyoming, Nevada, Utah, Colorado, Arizona and New Mexico

KMEncroachmentsEast@kindermorgan.com
Tennessee, Kentucky, West Virginia, Ohio and Michigan

Kinder Morgan will review the material submitted and may contact you to discuss the project, if needed. All requests are handled in the order that they are received. The time required to conduct an encroachment review varies depending upon the volume of requests received, the nature of the proposed encroachment and the proximity to Kinder Morgan assets. The approximate timeline for a full review is ten (10) weeks from the date all requested information is received; however, this timeline is subject to change.

SECTION 6 - KM USE ONLY

Reviewed By		Date Received (MM/DD/YY)	Date Approved (MM/DD/YY)
Pipeline/lateral name	KM Station/Mile Post #	Encroachment Number	Date Constructed (MM/DD/YY)

Sweetwater County, Wyoming
County License Application Form

Sweetwater County Engineering
80 West Flaming Gorge Way, Suite 23
Green River, WY 82935
p: (307) 872-3920 / 922-5428 f: 872-3991

☐ ***Application Fee - Type A: $225.00***
☐ ***Application Fee - Type B: $ 75.00***

Project Number: _____
Application Date: _____
PID: 04- ____ - __ - _ - __ - ___ - __

☐ Fee Paid? Check Number: _____
☐ Site Plan Included?

Type A License - Used for utilities crossing under a County Road or paralleling the road for 1,000 feet or more.

Type B License - Used for utilities suspended across a County Road or paralleling the road for less than 1,000.

APPLICANT INFORMATION:

GR-RS-SC Joint Powers Water Board
Company Name

Bryan Seppie, P.E.
Primary Contact

P.O. Box 1299
Company Mailing Address

307 875-4317 ext 230
Primary Contact Phone Number

Green River Wyoming 82935

Emergency Contact

307 875-4317
Company Telephone/Email

Emergency/Afterhours Phone Number

LOCATION INFORMATION:

Quarter(s): NW of SW Section: 31 Township: 19N Range: 105W

County Road(s): White Mountain Road

Approximate Location: Where White Mountain Road crosses the section line between sections 31 and 32

This site is about 0.25 miles west of the entrance to the Sweetwater Trap Club.

Purpose of Project: Install a 30-inch SDR 25 PVC water transmission pipeline and appurtenances.

Date Work Will Begin: Late Summer/Fall 2026 Date Work Will End: Summer 2027

TO BE COMPLETED BY COUNTY

PERMIT APPROVAL:

Field inspected and checked by: _____ Date: _____

Approved by: _____ Date: _____

This permit: ☐ Shall not expire. ☐ Shall expire in _____ days.

ATTACHMENT

The Licensee agrees to locate and mark the facility being licensed in the following manner:

1. The utility company or facility owner, as a condition of approval for the attached license, agrees to locate the facility identified by the license, when needed by the County Engineer for future construction and maintenance activities. This information will be the basis of plans prepared by the County Engineer for use by the County and the County's contractors. If relocation of the identified facility is necessary to aid the County's work, reimbursement will be as provided for by law.
2. Location information will include the marking of the facility on the ground, as specified by W.S. 37-12-302 et sep., with the appropriate color. Location information will also include the nature and elevation of the facility. For each location, the utility shall be tied both horizontally and vertically, by coordinates, to a datum determined by the County Engineer and certified by a licensed surveyor. The information will be shown on plans created by the utility company or facility owner. A copy of the plans will be sent to the County Clerk's Office. Costs associated with identifying and locating the facilities will be the responsibility of the company or facility owner on Department right of way.
3. For paved roads, the buried line must be bored. For gravel or dirt roads, the buried line may be trenched. Minimum depths are 3-1/2 feet below the ditch flow lines or 5-1/2 feet below the crown point of the road.

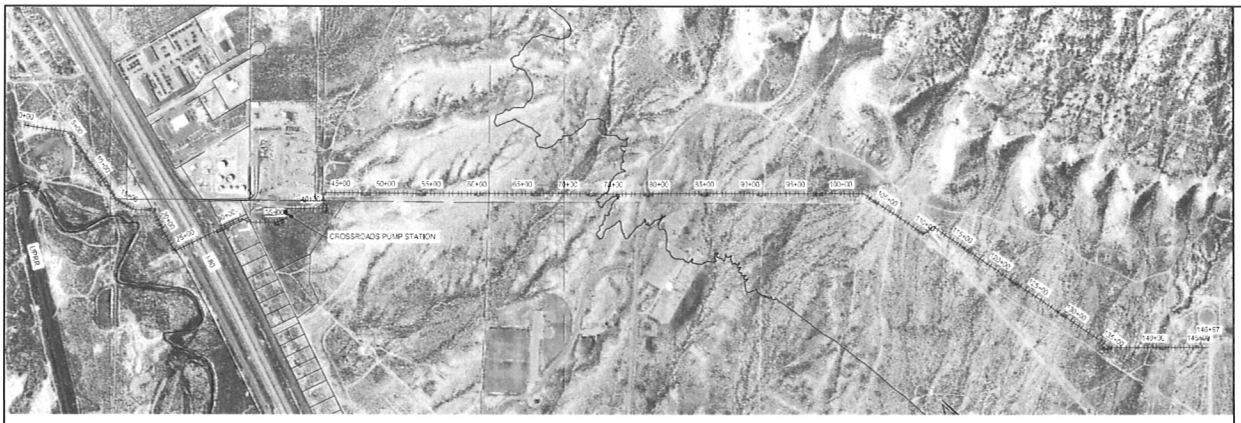
APPLICATION INSTRUCTIONS AND AGREEMENT

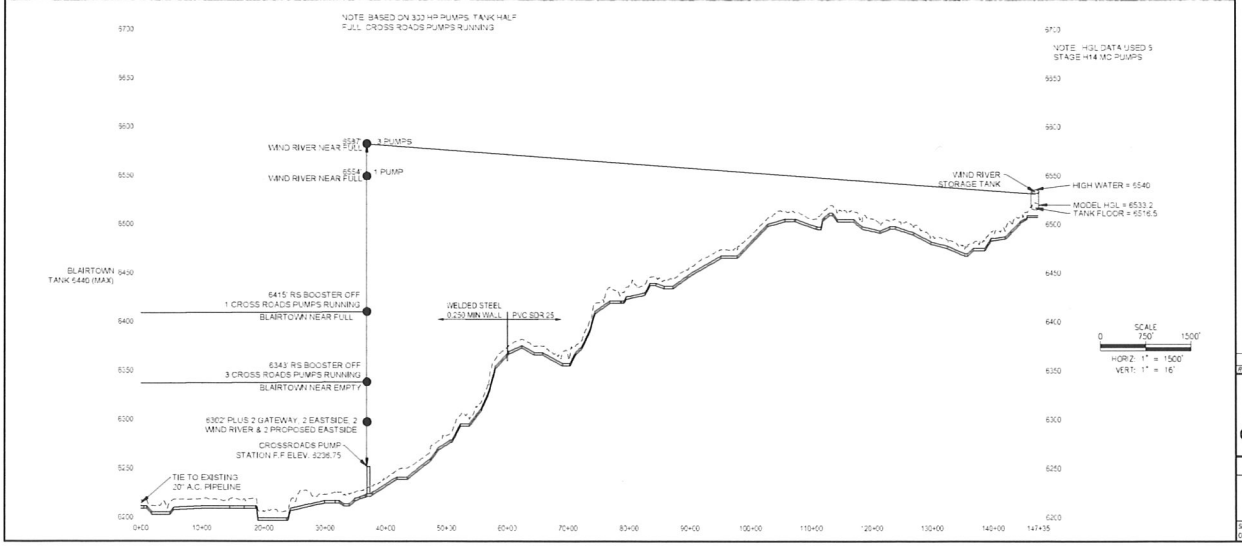
1. It may take up to two weeks to process your permit application due to physical inspection of the application site.
2. Include a detailed site plan of the project location. This site plan should include a profile of the road crossing showing depths from ditch flow lines and road crown, if applicable, and a section tie with bearing and distance from the nearest section corner to the actual utility line crossing. All utility crossings must be perpendicular to the travelway centerline.
3. By signing below, you are requesting permission to conduct operations in the County right-of-way, subject to conditions, and agree to the following:
   a. The utility will be placed in a manner that conforms to recognized standards, applicable Federal, State, or local laws, codes and ordinances and as directed by the Public Works Director.
   b. Any future alteration or modification of the utility within the existing right of way, required and requested by the County, shall be completed without delay and cost to the County.
   c. The alignment and grade, clearance, materials, pressures, land ties and mile post ties are shown on the plan sheet dated Nov 26, 2025.
   d. The License will not be modified, transferred or assigned without the consent of the County.
   e. The Licensee agrees to conform to the standards for traffic control as outlined in the Manual of Uniform Traffic Control Devices (MUTCD). The Licensee must cease all operations if the traffic control standards are not met.
   f. To the extent of the Licensee's negligence, therefore, the Licensee agrees to forever indemnify the County and save it harmless from all liability for damage to property or injury to or death of persons, including all costs and expenses relating thereto, arising wholly or in part or in connection with the existence of construction, alterations, repairs, renewals, or uses or removals of the utility as pertain to any County Road.
   g. Right of way markers for buried utilities are required effective August 1997.
   h. All excavated crossings must meet highway standards - 95% compaction. Surface material must be equal to or better than existing surface material.
   i. Additional requirements: _____

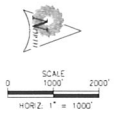
Bryan Seppie
Signature of Representative

2/9/26
Date

Bryan Seppie
Print Name and Title







REV NO.	COMMENT	DATE

FOR PERMIT ONLY NOT FOR CONSTRUCTION

SUNRISE ENGINEERING
772 S WASHINGTON ST.
AFTON, WYOMING 83110
TEL 307.885.0330 FAX 307.885.0321

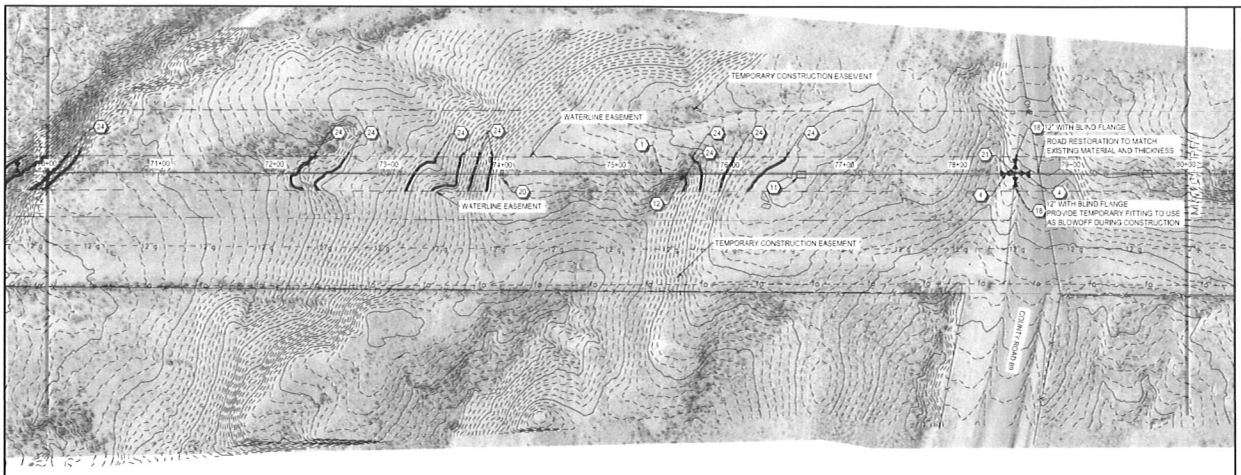
GR-RS-SC JPWB

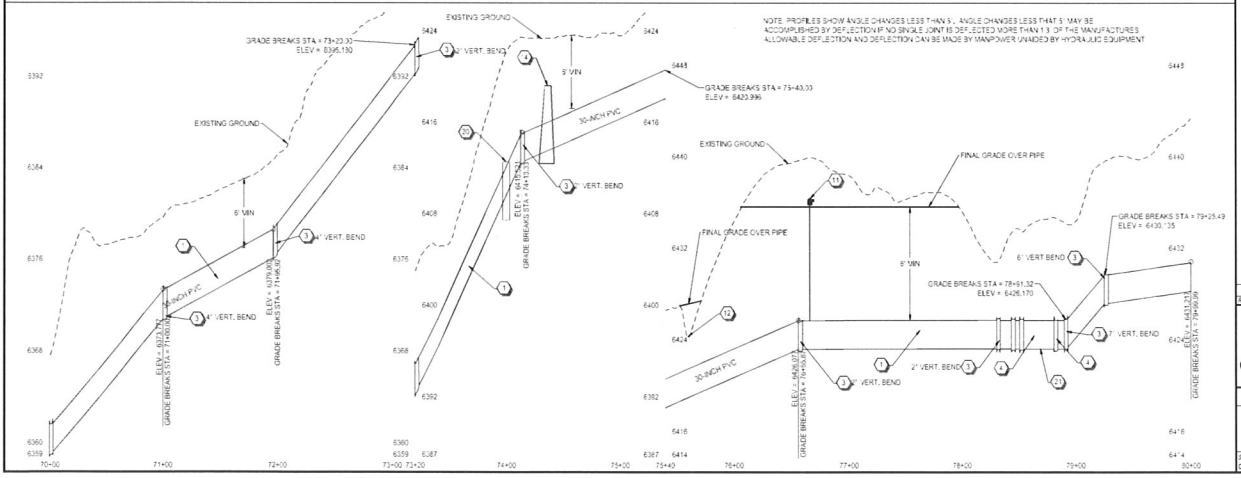
CROSSROADS PUMP STATION

HYDRAULIC GRADE PROFILE

SE NO	DESIGNED	DRAWN	CHECKED	SHEET NO	
07265	TDK	BJ	AA	5 of 99	HP

P:\WRDC GR-RS-SC JPWB Cross Roads Pump Station Level 1\ (SE07265)\Dwg (CAD)\Civil\Masterfile\Plan & Profile\Complete Profile.dwg Nov 17, 2023 12:38pm tjenkins





WATERLINE NOTES:

1. NEW 30" WATERLINE PER
2. CONNECT TO EXISTING 12" WATERLINE PER
3. BEND (90, 45, 22½, ETC.) WITH THRUST BLOCK
4. BUTTERFLY VALVE PER
5. BLOWOFF ASSEMBLY PER
6. TEE WITH THRUST BLOCK PER
7. CONNECT TO EXISTING 20" WATERLINE PER
8. MANWAY WITH AIR/VAC PER
9. MANWAY WITH AIR RELEASE PER
10. MANWAY PER
11. AIR/VAC VALVE PER
12. EPHEMERAL WASH CROSSING PER
13. CONNECT TO EXISTING 18" WATERLINE PER
14. CLAY CUT-OFF WALL PER
15. 2-PIECE BEND
16. 3-PIECE BEND
17. JIM BRIDGER PIPELINE CROSSING
18. GATE VALVE PER DETAIL
19. WEAK SOILS CROSSING
20. CONCRETE PIPELINE ANCHOR
21. 30"x12" CROSS WITH THRUST BLOCK PER
22. CHECK VALVE VAULT
23. EROSION BLANKET PER
24. SEDIMENT LOG/WATTLE PER
25. FIRE HYDRANT PER

NORTH

SCALE
0 40' 80'
HORIZ: 1" = 80'

811 Know what's below. Call before you dig. 1-800-849-2476

REV NO	COMMENT	DATE

NOT FOR CONSTRUCTION

SUNRISE ENGINEERING
773 S WASHINGTON ST.
AFTON, WYOMING 83110
TEL 307.885.8130 FAX 307.885.8501

GR-RS-SC JPWB

CROSSROADS PUMP STATION

PLAN AND PLOTTING

JOB NO	DESIGNED	DRAWN	CHECKED	SHEET NO	
07265	FCN	BJ	JA	22 of 99	PP8

P:\WWDC GR-RS-SC JPWB Cross Roads Pump Station Level III (07265)\Dwg C&D\Sheets\Plan & Profile1.dwg Nov 26, 2025 10:31am bjenkins

Return to:
Rocky Mountain Power
Lisa Louder/Erik Carlson
1407 West North Temple Ste. 110
Salt Lake City, UT 84116

NON-EXCLUSIVE ENCROACHMENT AGREEMENT

This Encroachment Agreement ("Agreement") is entered into this _____ day of _____, including all Exhibits attached hereto, is entered by and between **PacifiCorp, an Oregon Corporation**, with an office located at 1407 West North Temple, Salt Lake City, Utah 84116 ("PacifiCorp") and the City of Green River, Wyoming- City of Rock Springs, Wyoming- Sweetwater County, State of Wyoming Joint Powers Water Board ("JPWB"), located at #3 Telephone Canyon Road, Green River, WY 82935.

RECITALS

A. JPWB intends to construct, install, operate, and maintain a 30-inch PVC water pipeline (the "JPWB Line") in Sweetwater County, State of Wyoming in accordance with the plans/specifications attached as Exhibit A.

B. Certain segments of the JPWB Line will be constructed, operated and maintained within PacifiCorp's existing water supply pipeline corridor wherein PacifiCorp owns and operates a 36-inch raw water supply line, and other related infrastructure ("Waterline"). In these locations, PacifiCorp holds easements for its waterline and JPWB has acquired easements for the JPWB Line that cross PacifiCorp's existing easements (collectively, the "Easement Area"). The points of intersection at which PacifiCorp's Waterline and the JPWB Line cross are hereafter referred to as the "Crossing", as further described and depicted in Exhibit A.

C. By this Agreement the parties intend to set forth their respective rights, duties and obligations as to each other in the furtherance of the use of the easements for the purpose of avoiding conflicts and interference of their respective easement rights. Nothing in this Agreement waives or diminishes either party's existing easement rights except as expressly provided herein.

NOW, THEREFORE, in exchange of the mutual promises set forth herein and for other good and valuable consideration the receipt and sufficiency of which is hereby acknowledged, the parties agree to the following terms and conditions:

1. Location of Joint Use.

The location, design plans, and specifications of the JPWB Line are attached hereto as Exhibit "A" and by this reference made a part of this Agreement. JPWB agrees not to make any material modifications to the design plans and specifications or actual location of the JPWB Line without

first seeking approval from PacifiCorp, which approval shall not be unreasonably withheld or delayed, to ensure proper clearance standards and protective measures are met with respect to PacifiCorp's existing facilities. PacifiCorp shall respond to written requests within fifteen (15) business days; failure to respond timely shall be deemed approval.

2. Restrictions Pertaining to JPWB.

2.1 PacifiCorp's Waterline shall be considered as being pressurized at all times, without the ability to be scheduled for outages. JPWB recognizes and acknowledges that the Waterline is critical to PacifiCorp's operations and providing safe and reliable power to its customers. JPWB and/or its contractors must immediately notify PacifiCorp of any contact with the Waterline by any object or person made during construction and operation of the JPWB Line.

2.2 The JPWB Line where crossing the water line easement shall be constructed to maintain a minimum of 6 feet of soil cover above the PacifiCorp's Waterline across the width of the easement. A minimum clearance of 2 feet shall be maintained between the Waterline and JPWB Line. For crossing below the Waterline excavation shall be limited to provide no greater than 12 foot unsupported of the Waterline. Backfill below the centerline of the pipeline shall be completed utilizing flowable line. Sand back fill shall be installed to 12 inches above the pipeline. Compacted fill shall be utilized for the balance of the fill to top of grade.

2.3 **Protection of PacifiCorp's Facilities**. PacifiCorp's Waterline and other facilities shall be protected during construction and operation activities and JPWB shall make all efforts to avoid interference with PacifiCorp's operations. Without limiting or waiving any other protection requirements, the following protection measures shall be used to protect PacifiCorp's facilities in the Easement Area:

a. Prior to commencing construction operations or maintenance of the JPWB Line when excavation of the Easement Area is required, JPWB agrees to identify the exact location and depth of PacifiCorp's Waterline through hydro-excavation. JPWB shall notify PacifiCorp no less than 72 hours prior to hydro-excavating and backfill of the Waterline to allow for a PacifiCorp representative to witness and inspect the Crossing and construction activities if desired. JPWB shall not excavate closer than 25 feet to the Waterline or other PacifiCorp facility unless approval to do so has been given to JPWB in writing. Upon review of the JPWB Line drawings and staking of the JPWB Line centerline PacifiCorp, reserves the right to increase this distance as needed to maintain structural integrity of its Waterline.

b. All laws, regulations, rules, ordinances, codes and standards restricting and or qualifying activities within certain distances of energized electric lines and pressurized waterlines shall be obeyed.

c. Water, condensation, and moisture do occur near waterlines and the JPWB Line shall be built appropriately. JPWB shall prevent explosion, ignition, and arcing caused by undertaking at least the following preventative measures:

i. JPWB will not store any fuels, solvents, hazardous, flammable volatile materials, and substances or allow the storing of such materials and substances within the Easement Area;

ii. Ground and bond all fuel delivery and receiving equipment. Diesel fueling and refueling shall be allowed within the Easement Property, provided that all other fueling and refueling shall take place at a minimum distance of 50 feet from PacifiCorp's Waterline or at locations designated by PacifiCorp.

iii. Not to intentionally release natural gas, volatile, flammable, or explosive materials within the Easement Area or within 50 feet of PacifiCorp's Waterline.

d. JPWB shall exhaust all possibilities to avoid blasting and explosives within the Easement Area. In the event blasting and explosives are necessary, an advance written notice outlining blasting and safety procedures shall be provided to PacifiCorp. In no event shall blasting and explosives be used that could cause damage to PacifiCorp's facilities.

e. Adequate fire suppression shall be used at all times.

f. During construction and operation of the JPWB Line, dust shall be maintained and controlled over the Easement Area.

g. Markers with warning signs, identification and emergency telephone number shall be installed and maintained where the JPWB Line enters and leaves the Easement Area, at the Crossing, and at fifteen (15) feet from the centerline of the Waterline on each side of the Crossing. The markers will be 4" diameter steel pipe markers or similar. Signs will not be spaced any farther apart than 500 feet or line of site.

h. Earth, spoils, materials, supplies, or equipment of any kind may not be stock-piled, parked, or stored within five (5) feet of the Waterline or in such proximity to said Waterline that they would block access to PacifiCorp's facilities.

i. PacifiCorp shall have the right to have an inspector on site at any time during construction.

j. As-Built Drawings. JPWB agrees to provide to PacifiCorp an as-built survey of the locations of the JPWB Line within six months or as soon thereafter as reasonably possible after construction completion. The as-built survey shall also indicate offsets from PacifiCorp's Waterline and locations where, due to ground conditions, the JPWB Line is buried less than the minimum three (3) foot requirement. The as-built survey coordinates and drawings shall be determined, stamped, and signed by a Wyoming licensed Professional Land Surveyor.

k. The restrictions, duties, and obligations listed herein shall apply to JPWB, its employees, contractors, affiliates, or assigns.

2.4 Corrosion, Cathodic Protection and Induced Voltages. All measures, necessary shall be taken by JPWB to prevent corrosion damage of any nature to the Waterline or any other facilities owned by PacifiCorp. In advance of construction, technical studies designed to demonstrate that PacifiCorp's facilities will not be damaged due to the installation of corrosion/cathodic protection system shall be conducted by JPWB at its sole cost and expense. Such studies will consider: 1) the preliminary design or the corrosion/cathodic protection system impacts on PacifiCorp's facilities; 2) a description of corrosion prevention measures to protect these facilities; and 3) a report detailing methods to be used to identify future corrosion interference problems and the procedures to resolve interference attributed to the JPWB Line. JPWB shall install any required protection devices at its expense. PacifiCorp shall have no liability for any damages to the JPWB Line as a result of operation or use of its Waterline related to this sub-section and shall have no duty or obligation to install any protective devices to the JPWB Line.

2.5 JPWB shall within a reasonable period of time after completion of the project restore the easement area to as near as practicable its condition prior to installation of the JPWB Line.

3. Restrictions Pertaining to PacifiCorp

3.1 Protection of JPWB Facilities. The JPWB Line and other JPWB owned facilities shall be protected during any construction, maintenance and operation activities PacifiCorp may take within the Easement Area, and PacifiCorp shall make commercially reasonable efforts to avoid interference with JPWB operations. Without limiting or waiving any other protection requirements, the following protection measures shall be used to protect JPWB facilities:

a. PacifiCorp shall not excavate, place power poles or guy wires closer than 25 feet to the JPWB Line unless approval to do so has been given to PacifiCorp in writing. In taking any activities, PacifiCorp must comply with Wyoming's Underground Facilities Notification Act, Wyoming Statute § 37-12-301 *et seq.*

b. PacifiCorp shall provide at least five (5) business days' prior written notice before performing work near the Crossing (except in emergencies), and shall promptly notify JPWB of any emergency affecting JPWB's facilities and coordinate response.

c. All laws, regulations, rules, ordinances, codes and standards restricting and or qualifying activities within certain distances of the JPWB Line shall be obeyed.

d. PacifiCorp shall exhaust all possibilities to avoid blasting and explosives within the Easement Area. In the event blasting and explosives are necessary, 48 hours advance written notice outlining blasting and safety procedures shall be provided to JPWB. In no event shall blasting and explosives be used that could cause damage to JPWB facilities.

e. Adequate fire suppression shall be used at all times.

f. No additional structures or other improvements requiring footings are permitted within the Easement Area without the written consent of JPWB.

g. No changes in grade over the JPWB Line or JPWB Easement are permitted.

h. PacifiCorp may not restrict access to the Easement Area without first notifying JPWB and providing JPWB with alternative access satisfactory to JPWB.

4. Miscellaneous Provisions.

4.1 Amendments. This Agreement may be amended only by an instrument in writing reciting such amendment, bearing the acknowledged signatures of all parties hereto, or their successors and assigns.

4.2 Due Authorization. The individuals executing this document each represents and warrants (i) that he or she is authorized to do so on behalf of the respective parties hereto, (ii) that he or she has full legal power and authority to bind the respective parties hereto, and if necessary, has obtained all required consents or delegations of such power and authority (whether from any partner, owner, spouse, shareholder, director, member, manager, creditor, investor, developer, governmental authority, judicial or administrative body, association or other person or entity), and (iii) that the execution, delivery and performance by the respective parties hereto of this document will not constitute a default under any agreement to which it is a party.

4.3 Indemnification. Each party (Indemnitor) shall indemnify, defend, and hold harmless the other party (Indemnitee), and their officers, employees, and agents, from and against claims, damages, losses, liabilities, costs, and expenses (including reasonable attorneys' fees) to the extent caused by the negligence or willful misconduct of the Indemnitor or its contractors, employees, or agents in connection with the design, construction, operation, maintenance, repair, or removal of its facilities within the Easement Area. No party shall be responsible for the other party's proportionate negligence, and nothing herein requires indemnification for the other party's sole negligence or willful misconduct. The Indemnitee shall provide prompt notice of any claim.

4.4 Counterpart Execution. This document may be executed and acknowledged in counterparts, all of which executed and acknowledged counterparts shall together constitute a single document. Signature and acknowledgment pages may be detached from the counterparts and attached to a single copy of this document to form physically one document, which may be recorded.

4.5 JURY TRIAL WAIVER. TO THE FULLEST EXTENT PERMITTED BY LAW, EACH OF THE PARTIES HERETO WAIVES ANY RIGHT IT MAY HAVE TO A TRIAL BY JURY IN RESPECT OF LITIGATION DIRECTLY OR INDIRECTLY ARISING OUT OF, UNDER OR IN CONNECTION WITH THIS AGREEMENT. EACH PARTY FURTHER WAIVES ANY RIGHT TO CONSOLIDATE ANY ACTION IN WHICH A JURY TRIAL HAS BEEN WAIVED WITH ANY OTHER ACTION IN WHICH A JURY TRIAL CANNOT BE OR HAS NOT BEEN WAIVED.

Nothing herein shall be construed as a waiver of JPWB's governmental immunity or other protections under Wyoming law.

4.6 Governing Law, Venue, and Dispute Resolution. This Agreement shall be governed by the laws of the State of Wyoming. Venue shall lie in the District Court for Sweetwater County, Wyoming. The parties shall first attempt to resolve disputes through good-faith negotiation and, if unresolved, through mediation before commencing litigation.

4.7 Notices. All notices under this Agreement shall be in writing and delivered by hand, overnight courier, or email with confirmation to the addresses above or as updated by notice.

4.8 Term, Termination, and Survival. This Agreement shall remain in effect for so long as the Crossing exists, unless terminated by mutual written consent or upon abandonment and removal of JPWB's facilities at the Crossing. Indemnity, dispute resolution, and restoration obligations survive termination.

[Signature Page Follows]

IN WITNESS WHEREOF, the parties hereto have caused this agreement to be executed in duplicate by their respective officials thereunto duly authorized.

PACIFICORP

By Heather

Its SENIOR DIRECTOR JIM BRIDGER POWER PLANT

CITY OF GREEN RIVER, WYOMING-CITY OF ROCK SPRINGS, WYOMING-SWEETWATER COUNTY, STATE OF WYOMING JOINT POWERS WATER BOARD

By Bryan Sayer

Its General Manager

STATE OF)
)SS:
COUNTY OF)

On the 13 day of February, 2026, personally appeared before me Melissa Stewart, who being by me duly sworn, did say that (s)he is the Senior Director, of **PacifiCorp**, an Oregon Corporation, and that the within and foregoing instrument was signed in behalf of said corporation by authority of said officer duly acknowledged to me that said corporation executed the same.

MELISSA STEWART
Notary Public - State of Wyoming
Commission ID # 171183
My Commission Expires
April 29, 2031

Melissa Stewart
Notary Public

STATE OF Wyoming)
)SS:
COUNTY OF Sweetwater)

On the 10th day of February 2026 personally appeared before me Carrie Halter, who being by me duly sworn, did say that (s)he is the General Manager, of GRRS/Sweetwater County Joint Powers Water Board, and that the within and foregoing instrument was signed in behalf of said corporation by authority of said officer duly acknowledged to me that said corporation executed the same.

Carrie Halter
Notary Public

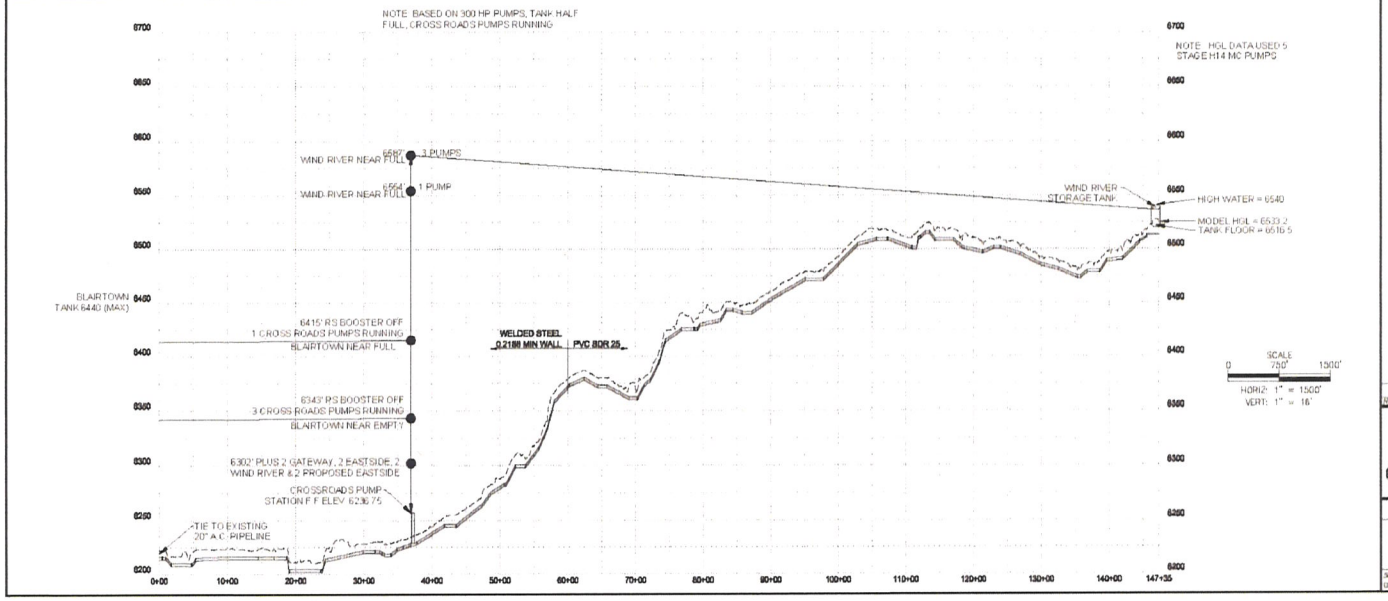
CARRIE HALTER
NOTARY PUBLIC
STATE OF WYOMING
COMMISSION ID: 155205
MY COMMISSION EXPIRES: 09/24/2030

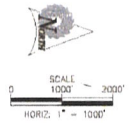
EXHIBIT A

Crossing located in the NWNW of Section 32, Township 19 North, Range 105 West, 6th PM as shown

(see attached)







REV NO.	COMMENT	DATE

NOT FOR BID OR CONSTRUCTION

SUNRISE ENGINEERING
1709 Washington St.
Afton, Wyoming 83110
TEL 307.885.9500 • FAX 307.885.9501
www.sunrise-eng.com

GR-RS-SC JPWB

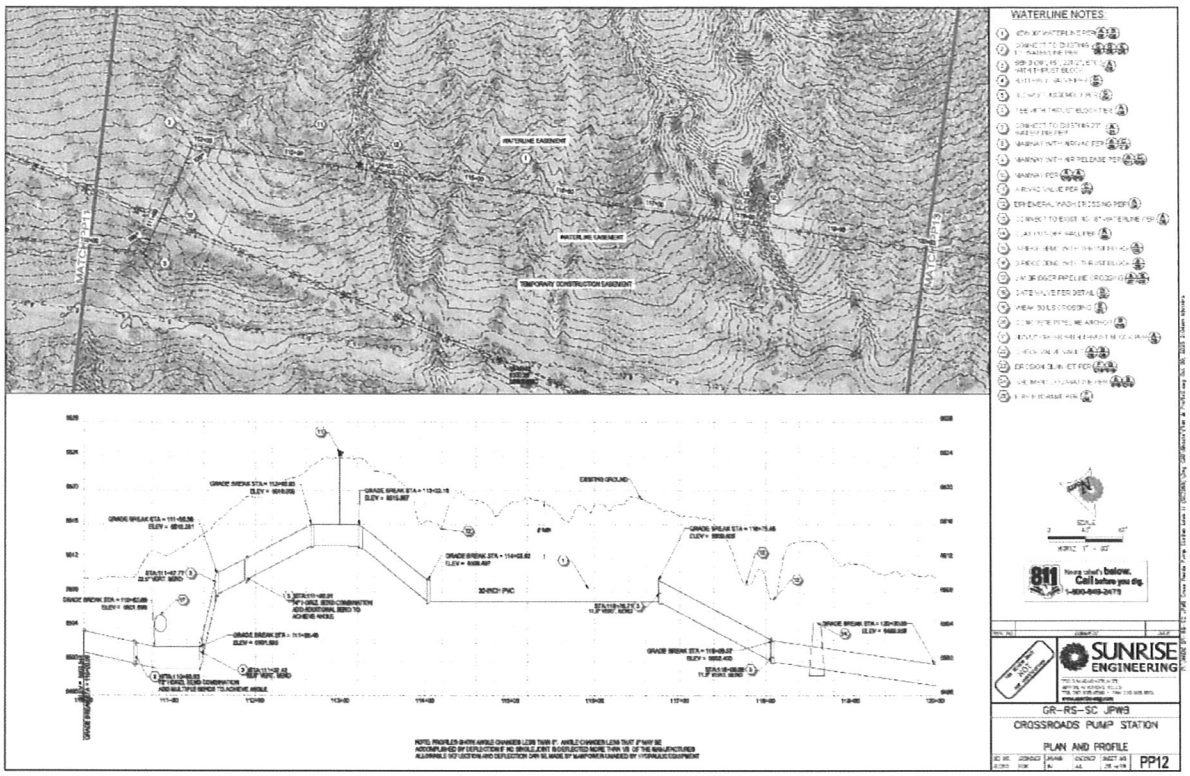
CROSSROADS PUMP STATION

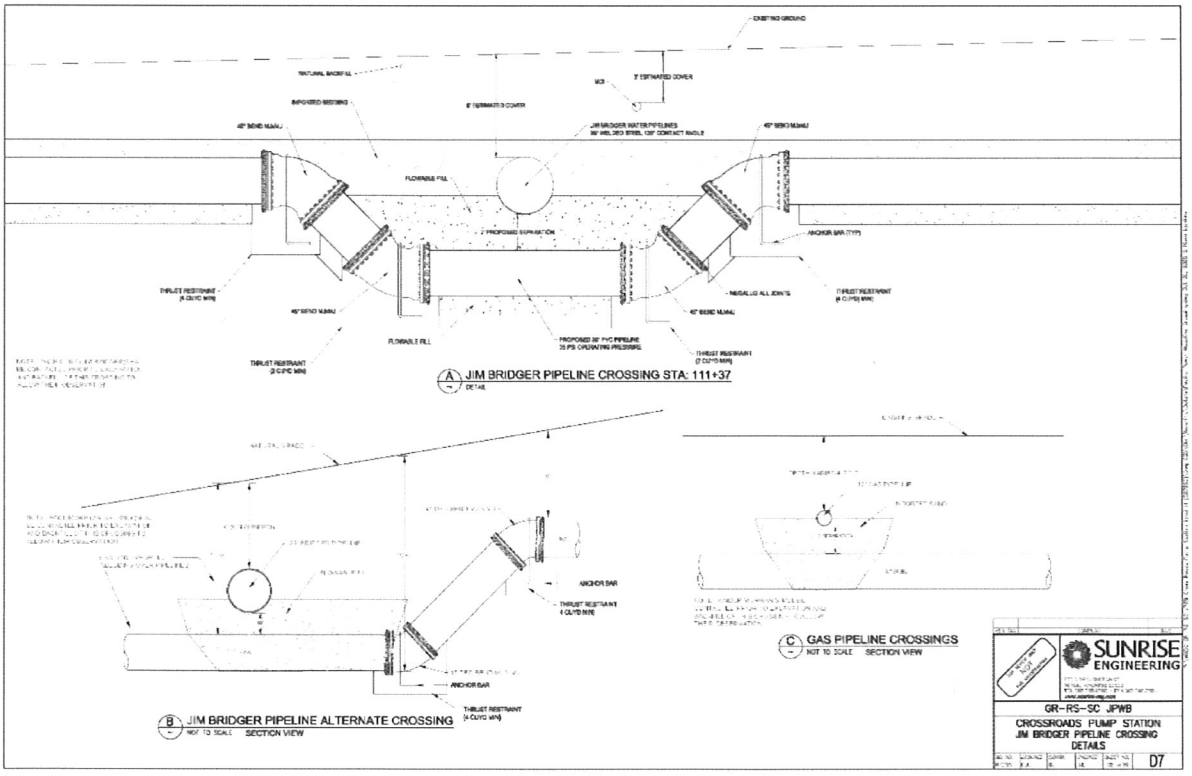
HYDRAULIC GRADE PROFILE

JOB NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.
07785	FDK	BJ	JJL	5 of 99

HP

P:\2023 JPWB Crossroads Pump Station Level II (SUNRISE)\Civil CSD\CAD Files\Plan & Profile\Complete Profile.dwg Oct 05, 2023 1:38pm kmeiers


WATERLINE NOTES
WATERLINE EASEMENT
TEMPORARY CONSTRUCTION EASEMENT
811
SUNRISE ENGINEERING
GR-RS-SC JPWB
CROSSROADS PUMP STATION
PLAN AND PROFILE
PP12


A JIM BRIDGER PIPELINE CROSSING STA: 111+37
B JIM BRIDGER PIPELINE ALTERNATE CROSSING
NOT TO SCALE SECTION VIEW
C GAS PIPELINE CROSSINGS
NOT TO SCALE SECTION VIEW
SUNRISE ENGINEERING
GR-RS-SC JPWB
CROSSROADS PUMP STATION
JIM BRIDGER PIPELINE CROSSING
DETAILS
D7

SRF REQUIREMENTS

SRF SPECIAL CONDITIONS

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION -- LOWER TIER COVERED TRANSACTIONS

Instructions for Certification

1. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or had become erroneous by reason of changed circumstances.

4. The terms covered transaction, debarred, suspended, ineligible, lower tier covered transaction, participant, person, primary covered transaction, principal, proposal, and voluntarily excluded, as used in this clause, have the meaning set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

5. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is proposed for debarment under 48 CFR part 9, subpart 9.4, debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

6. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not proposed for debarment under 48 CFR part 9, subpart 9.4, debarred, suspended, ineligible, or voluntarily excluded from covered transactions, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is proposed for debarment under 48 CFR part 9, subpart 9.4, suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Covered Transactions

(1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

_____

Organization Name

_____

Name and Title of Authorized Representative

_____

Signature Date

United States Environmental Protection Agency

DWSRF279

SRF PROJECT #

CERTIFICATION REGARDING LOBBYING

CERTIFICATION FOR CONTRACTS, GRANTS, LOANS AND COOPERATIVE AGREEMENTS

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including sub-contracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31 U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

_____

Typed Name & Title of Authorized Representative

_____

Signature and Date of Authorized Representative

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EQUAL EMPLOYMENT OPPORTUNITY and AFFIRMATIVE ACTION REQUIREMENTS on FEDERALLY ASSISTED CONSTRUCTION CONTRACTS

Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

2. The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goal for minority participation for each trade	Goal for female participation in each trade
See goal listed below for county where covered area is located	6.9%

Minority Participation Goals:

For Albany, Campbell, Carbon, Converse, Fremont, Johnson, Laramie, Natrona, and Platte Counties - 7.5%.
For Big Horn, Hot Springs, Park, Sheridan, and Washakie Counties and Yellowstone National Park - 3.3%
For Lincoln, Sublette, Sweetwater, and Uinta Counties - 5.1%
For Crook, Niobrara, and Weston Counties - 7.9%
For Goshen County - 5.3%
For Teton County - 4.0%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor or from project to project for the sole purpose of meeting the contractor's goals shall be a violation of the contract, the

Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number for the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed. Use the form on the next page. Contractor shall also complete and submit this form to report its prime contract, regardless of whether it has any subcontractors. Contractor shall provide copies to Owner and Engineer.

4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is Sweetwater County, Wyoming.

This notice shall be included in, and shall be a part of, all solicitations for offers and bids on all Federal and federally assisted construction contracts or subcontracts in excess of $10,000 to be performed in geographical areas designated by the Director pursuant to 41 CFR 60-4.6.

CONTRACTOR'S NAME, ADDRESS & TELEPHONE NUMBER

_____

_____

_____

_____

Return to:

Joan Ford, Regional Director
US Department of Labor
Federal Building, Room 840
525 South Griffin St.
Dallas, TX 75202

Contractor Employer ID Number: _____

CONTRACT INFORMATION

PROJECT AND LOCATION:				
Dollar Amount of Contract	Estimated Start Date	Estimated Completion Date	Contract No.	Geographical Area (County, State)

NOTIFICATION OF SUBCONTRACTS AWARDED (>$10,000)

Subcontractor's Name Address, and Phone Number	Employer ID Number of Subcontractor	Estimated $ Amount of Subcontract	Estimated Start Date	Estimated Completion Date

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EQUAL OPPORTUNITY CLAUSES

A. The Equal Opportunity Clause published at 41 CFR 60-1.4(b) is required to be included in, and is part of, all nonexempt federally assisted construction contracts and subcontracts (including this Contract). The Equal Opportunity Clause shall be considered to be a part of every contract and subcontract required by the regulations to include such a clause, whether or not it is physically incorporated in such contracts. The notices required to be posted by paragraphs (1) and (3) of the Equal Opportunity Clause shall be the "Equal Employment Opportunity is the Law" poster approved by the Office of Federal Contract Compliance Programs and available on the internet at http://www.dol.gov/ofccp/regs/compliance/posters/ofccpost.htm.

EQUAL OPPORTUNITY CLAUSE (41 CFR 60-1.4(b))

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared

ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to enter into such litigation to protect the interests of the United States.

B. The Standard Federal Equal Employment Opportunity Construction Contract Specifications published at 41 CFR 60-4.3(a) are required to be included in, and are part of, all federal and federally assisted construction contracts and subcontracts (including this Contract) in excess of $10,000 to be performed in geographical areas designated by the Director pursuant to 41 CFR 60-4.6 and in construction subcontracts in excess of $10,000 necessary in whole or in part to the performance of non-construction Federal contracts and subcontracts covered under Executive Order 11246. These Specifications shall be considered to be a part of every contract and subcontract required by the regulations to include such a clause, whether or not it is physically incorporated in such contracts.

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)

1. As used in these specifications:

a. "Covered Area" means the geographical area described in the solicitation from which this contract resulted;

b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;

c. "Employer identification number" means the Federal Social Security number used on the employer's quarterly Federal Tax Return, U.S. Treasury Department Form 941.

d. "Minority" includes:

(i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

(ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

(iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands);

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area, (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The contractor shall implement the specific affirmative action standards provided in paragraphs (7)(a) through (p) of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the contractor should reasonably by able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the FEDERAL REGISTER in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the contractor during the training period, and the contractor must have made a commitment to employ the

apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the contractor's employees are assigned to work. The contractor, where possible, will assign two or more women to each construction project. The contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the contractor by the union or, if referred, not employed by the contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the areas which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the contractor's employment needs, especially those programs funded or approved by the Department of Labor. The contractor shall provide notice of these programs to the sources compiled under (7)(b) above.

f. Disseminate the contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by

specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions including specific review of these items with on-site supervisory personnel such as superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the contractor's EEO policy with other contractors and subcontractors with whom the contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a contractor's workforce.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of

solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7)(a) through (p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under (7)(a) through (p) of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the contractor. The obligation to comply, however, is the contractor's and failure of such a group to fulfill an obligation shall not be a defense for the contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the contractor has achieved its goals for women generally, the contractor may be in violation of the Executive order if a specific minority group of women is under-utilized).

10. The contractor shall not use the goals and timetables of affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The contractor shall not enter into any subcontract with any person or firm debarred from government contracts pursuant to Executive Order 11246.

12. The contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph (7) of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the contractor fails to comply with the

requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

PROHIBITION AGAINST LISTED VIOLATING FACILITIES

A. REQUIREMENTS

(1) To comply with all the requirements of section 114 of the Clean Air Act, as amended (42 U.S.C. 1857, et seq., as amended by Pub. L. 92-604) and section 308 of the Clean Water Act (33 U.S.C. 1251, as amended), respectively, which relate to inspection, monitoring, entry, reports, and information, as well as other requirements specified in section 114 and section 308 of the Air Act and the Water Act, respectively, and all regulations and guidelines issued thereunder before the award of this contract.

(2) That no portion of the work required by this prime contract will be performed in a facility listed on the Environmental Protection Agency list of violating facilities on the date when this contract was awarded unless and until the EPA eliminates the name of such facility or facilities from the listing.

(3) To use his best efforts to comply with clean air and clean water standards at the facilities in which the contract is being performed.

(4) To insert the substance of the provisions of this clause, including this paragraph (4), in any nonexempt subcontract.

B. DEFINITIONS

(1) Air Act means the Clean Air Act, as amended (42 U.S.C. 1857 et seq.).

(2) Water Act means the Clean Water Act, as amended (33 U.S.C. 1251 et seq.).

(3) Clean Air Standards means any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, or other requirements which are contained in, issued under, or otherwise adopted under the Air Act or Executive Order 11738, an applicable implementation plan as described in section 110 (d) of the Air Act (42 U.S.C. 1857c-5(d)), an approved implementation procedure or plan under section 111 (c) or section 111(d), or an approved implementation procedure under section 112(d) of the Air Act (42 U.S.C. 1857c-7(d)).

(4) Clean Water Standards means any enforceable limitation, control, condition, prohibition, standard, or other requirement which is promulgated under the Water Act or contained in a permit issued to a discharger by the Environmental Protection Agency or by a State under an approved program, as authorized by section 402 of the Water Act (33 U.S.C. 1342), or by a local government to ensure compliance with pretreatment regulations as required by section 307 of Water Act (33 U.S.C. 1317).

(5) Compliance means compliance with clean air or water standards. Compliance shall also mean compliance with a schedule or plan ordered or approved by a court of competent jurisdiction, the Environmental Protection Agency in accordance with the requirements of the Air Act or Water Act and regulations.

(6) Facility means any building, plant, installation, structure, mine, vessel, or other floating craft, location, or site of operations, owned, leased, or supervised by a contractor or subcontractor, to be used in the performance of a contract or subcontract. Where a location or site of operations contains or includes more than one building, plant, installation, or structure, the entire location or site shall be deemed to be a facility except where the Director, Office of Federal Activities, Environmental Protection Agency, determines that independent facilities are located in one geographical area.

WILLIAMS-STEIGER OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

A. AUTHORITY

(1) The contractor is subject to the provisions of the Williams-Steiger Occupational Safety and Health Act of 1970.

(2) These construction documents and the joint and several phases of construction hereby contemplated are to be governed, at all times, by applicable provisions of the Federal law(s), including but not limited to the latest amendment of the following:

a. Williams-Steiger Occupational Safety and Health Act of 1970, Public Law 94-596;

b. Part 1910 - Occupational Safety and Health Standards, Chapter XVII of Title 29, Code of Federal Regulations;

c. Part 1926 - Safety and Health Regulations for Construction, Chapter XVII of Title 29, Code of Federal Regulations.

B. SAFETY AND HEALTH PROGRAM REQUIREMENTS

(1) This project, its prime contractor, and its subcontractors, shall at all times be governed by Chapter XVII of Title 29, Code of Federal Regulations, Part 1926 - Safety and Health Regulations for Construction (29 CFR 22801), as amended to date.

(2) To implement the program and to provide safe and healthful working conditions for all persons, general project safety meetings will be conducted at the site at least once each month during the course of construction, by the construction superintendent or his/her designated safety officer. Notice of such meeting shall be issued not less than three (3) days prior, stating the exact time, location, and agenda to be included. Attendance by the owner, architect, general foreman, shop steward(s), and trades, or their designated representatives, witnessed in writing as such, shall be mandatory.

(3) To further implement the program, each trade shall conduct a short gang meeting, not less than once a week, to review project safety requirements mandatory for all persons during the coming week. The gang foreman shall report the agenda and specific items covered to the project superintendent, who shall incorporate these items in his/her daily log or report.

(4) The prime contractor and all subcontractors shall immediately report all accidents, injuries, or health hazards to the owner and architect, or their designated representatives, in writing. This shall not obviate any mandatory reporting under the provisions of the Occupational Safety and Health Act of 1970.

(5) This program shall become a part of the contract documents and the contract between the owner and prime contractor, prime contractor, and all subcontractors, as though fully written therein.

HUMAN TRAFFICKING

The Contractor and subcontractor(s) shall comply with all applicable requirements of 22 U.S.C. § 7104(g) and 2 CFR Part 175.

LIMITATIONS ON LOBBYING ACTIVITIES

The Contractor and subcontractor(s) certify and agree that, in accordance with P.L. 101-121, payments made from this contract shall not be utilized in connection with lobbying member(s) of Congress, or any federal agency in connection with this Agreement.

NONDISCRIMINATION

The Contractor and subcontractor(s) shall comply with the Civil Rights Act of 1964, the Wyoming Fair Employment Practices Act (Wyo. Stat. §27-9-105, et seq.), the Americans with Disabilities Act (ADA), 42 U.S.C. § 12101, et seq., and the Age Discrimination Act of 1975 and any properly promulgated rules and regulations thereto and shall not discriminate against any individual on the grounds of age, sex, color, race, religion, national origin, or disability in connection with the performance under this Agreement.

ANTI-KICKBACKS

Contractor shall comply with the Copeland "Anti-Kickback" Act (18 U.S.C. 874) as supplemented in the Department of Labor Regulations (29 CFR, Part 3). This Act provides that Contractor is prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he is otherwise entitled.

Contractor certifies and warrants that no gratuities, kickbacks, and contingency fees were paid in connection with this contract, nor were any fees, commissions, gifts, or other considerations made contingent upon the award of this contract.

Contractor certifies that, to Contractor's knowledge, no state employee has any personal or beneficial interest whatsoever in the services described in this Contract.

No staff member of Contractor, compensated either partially or wholly with funds disbursed pursuant to the Contract, shall engage in any Contract or activity which would constitute a conflict of interest as related to this Contract.

DISCOVERY OF ARCHAEOLOGICAL AND OTHER HISTORICAL ITEMS

In the event of an archaeological find during any phase of construction, the following procedure will be followed:

1. Construction shall be halted, with as little disruption to the archaeological site as possible.

2. Contractor shall notify Owner who shall contact the State Historic Preservation Officer.

3. The State Historic Preservation Officer may decide to have an archaeologist inspect the site and make recommendations about the steps needed to protect the site, before construction is resumed.

4. The entire event should be handled as expediently as possible in order to hold the loss in construction time to a minimum while still protecting archaeological finds.

A similar procedure should be followed with regard to more recent historical resources. Should any artifacts, housing sites, etc., be uncovered, the same procedure should be followed as for an archaeological find.

In the event archaeological/historical data are evaluated to meet National Register criteria, the Advisory Council on Historic Preservation may be notified and asked to comment by the Wyoming State Revolving Fund Program.

ACCESS

Contractor shall insure that authorized representatives of the Wyoming DEQ, Office of State Lands, Water Development Office, US EPA, Comptroller General, Inspector General, and other applicable federal and state agencies and officials will have access to the project work whenever it is in preparation or progress and shall provide proper facilities for such access and inspection. Contractor shall allow these representatives to have access to any books, documents, plans, reports, papers, and other records of Contractor which are pertinent to the project for the purpose of making audit, examination, excerpts, copies, and transcriptions thereof and to interview any officer or employee. Contractor shall insure that all subagreements will also afford access to such project work, sites, documents, records, and persons.

SITE EROSION AND SEDIMENT CONTROL MEASURES

Every effort shall be made by Contractor and subcontractors to prevent and correct problems associated with erosion and runoff processes which could occur during and after project construction. The efforts should be consistent with applicable local ordinances and the Nonpoint Source Pollution Control Guidance. Whenever appropriate, Contractor's efforts shall reflect the following engineering principles:

(a.) When appropriate, land grading and excavating should be kept at a minimum to reduce the possibility of creating runoff and erosion problems which require extensive control measures.

(b.) Whenever possible, topsoil should be removed and stockpiled before grading begins.

(c.) Land exposure should be minimized in terms of area and time.

(d.) Exposed areas subject to erosion should be covered as quickly as possible by means of mulching or vegetation.

(e.) Natural vegetation should be retained whenever feasible.

(f.) Early completion of stabilized drainage systems (temporary and permanent systems) will substantially reduce erosion potential.

(g.) Roadways and parking lots should be paved or otherwise stabilized as soon as feasible.

(h.) Clearing and grading should not be started until a firm construction schedule is known and can be effectively coordinated with grading and clearing activity.

WYPDES CONSTRUCTION RELATED DISCHARGE PERMITS

Construction projects which will disturb 5 acres or more require coverage under the State of Wyoming General Permit for Storm Water Discharges Associated with Large Construction Activities. Construction projects which will disturb 1 acre or more but less than 5 acres require coverage under the State of Wyoming General Permit for Storm Water Discharges Associated with Small Construction Activities. Contractor is responsible for obtaining coverage under the appropriate permit and maintaining compliance until Owner accepts the Work as complete. For additional information see http://deq.wyoming.gov/water-quality/wypdes/discharge-permitting/storm-water-permitting/ or contact Anita Rehner at 307-777-5622.

Certain construction activities such as dewatering, flushing, testing, and disinfection require coverage under a State of Wyoming General Permit for Temporary Discharges or under a separate discharge permit. Contractor is responsible for obtaining any necessary coverage and maintaining compliance. For more information see http://deq.wyoming.gov/water-quality/wypdes or contact Kathy Shreve at 307-777-7093.

EQUIPMENT STAGING

Equipment shall be staged, serviced, and fueled at least 300 feet from streams and riparian areas.

AQUATIC INVASIVE SPECIES

Preventing the spread of aquatic invasive species (AIS) is a priority for the State of Wyoming, and, in many cases, the intentional or unintentional spread of organisms from one body of water to another would be considered a violation of state statute and Wyoming Game and Fish Commission Regulation. To prevent the spread of AIS, the following is required:

1. If equipment has been used in a high risk infested water [a water known to contain Dreissenid mussels* (zebra/quagga mussels)], the equipment must be inspected by an authorized aquatic invasive species inspector recognized by the state of Wyoming prior to its use in any Wyoming water during all times of year.

2. Any equipment entering the State by land from March through November (regardless of where it was last used), must be inspected by an authorized aquatic invasive species inspector prior to its use in any Wyoming water.

3. If aquatic invasive species are found, the equipment must be decontaminated by an authorized aquatic invasive species decontaminator.

4. Any time equipment is moved from one 4th level (8-digit Hydrological Unit Code) watershed to another within Wyoming, the following procedure is required:

a. DRAIN: Drain all water from watercraft, gear, equipment, and tanks. Leave wet compartments open to dry.

b. CLEAN: clean all plants, mud, and debris from vehicle, tanks, watercraft, and equipment.

c. DRY: Dry everything thoroughly. Dry for 5 days in Summer (June-August), 18 days in Spring (March-May) and Fall (September-November), or 3 days in Winter (December-February) when temperatures are at or below freezing.

5. Any equipment used in Wyoming water that contains AIS must be inspected before use in another water. Species currently found in Wyoming waters include New Zealand mudsnail, Asian clam, and curly pondweed. Information on currently affected waters can be found at: https://wgfd.wyo.gov/Fishing-and-Boating/Aquatic-Invasive-Species-Prevention/AIS-Resources.

*A list of high risk infested waters and locations in Wyoming to obtain an AIS inspection can be found at wgfd.wyo.gov/AIS.

AIR QUALITY PROTECTION MEASURES

Contractor shall adhere to effective dust control procedures as required under the Wyoming Air Quality Standards and Regulations (WAQSR) Chapter 3 Section 2 (Emission standards for particulate matter), especially part (f). If asbestos is encountered during this project, Contractor shall follow standards for handling according to WAQSR Chapter 3 Section 8. Contractor shall adhere to proper trade waste and materials disposal according to WAQSR Chapter 10 Section 2.

PRESERVATION OF OPEN COMPETITION AND GOVERNMENT NEUTRALITY TOWARDS GOVERNMENT CONTRACTORS' LABOR RELATIONS ON FEDERAL AND FEDERALLY FUNDED CONSTRUCTION PROJECTS

The assistance recipient agrees to comply with Executive Order 13202 (Feb. 22, 2001, 66 Federal Register 11225) of February 17, 2001, entitled "Preservation of Open Competition and Government Neutrality Towards Government Contractors' Labor Relations on Federal and Federally Funded Construction Projects," as amended by Executive Order 13208 (April 11,

2001, 66 Federal Register 18717) of April 6, 2001, entitled "Amendment to Executive Order 13202, Preservation of Open Competition and Government Neutrality Towards Government Contractors' Labor Relations on Federal and Federally Funded Construction Projects.

Amend 48 CFR Part 36.202 by adding paragraph (d) to read as follows:

(d) In accordance with Executive Order 13202, of February 17, 2001, Preservation of Open Competition and Government Neutrality Towards Government Contractors' Labor Relations on Federal and Federally Funded Construction Projects, as amended on April 6, 2001--

(1) The Government, or any construction manager acting on behalf of the Government, must not--

(i) Require or prohibit offerors, contractors, or subcontractors to enter into or adhere to agreements with one or more labor organizations (as defined in 42 U.S.C. 2000e(d)) on the same or other related construction projects; or

(ii) Otherwise discriminate against offerors, contractors, or subcontractors for becoming, refusing to become, or remaining signatories or otherwise adhering to agreements with one or more labor organizations, on the same or other related construction projects.

(2) Nothing in this paragraph prohibits offerors, contractors, or subcontractors from voluntarily entering into project labor agreements.

(3) The head of the agency may exempt a construction project from this policy if the agency head finds that, as of February 17, 2001--

(i) The agency or a construction manager acting on behalf of the Government had issued or was a party to bid specifications, project agreements, agreements with one or more labor organizations, or other controlling documents with respect to that particular project, which contained any of the requirements or prohibitions in paragraph (d)(1) of this section; and

(ii) One or more construction contracts subject to such requirements or prohibitions had been awarded.

(4) The head of the agency may exempt a particular project, contract, or subcontract from this policy upon a finding that special circumstances require an exemption in order to avert an imminent threat to public health or safety, or to serve the national security. A finding of "special circumstances" may not be based on the possibility or presence of a labor dispute concerning the use of contractors or subcontractors who are nonsignatories to, or otherwise do not adhere to, agreements with one or more labor organizations, or concerning employees on the project who are not members of or affiliated with a labor organization.

REQUIRED WYOMING STATUTE LANGUAGE

Pursuant to W.S. 16-6-104, Wyoming made materials and products, and Wyoming suppliers of products and materials of equal quality and desirability shall have preference over materials or products produced or supplied outside the state and any contract let shall so provide. The preference created by this section shall be applied in a manner identical to the preference for residence contractors in W.S. 16-6-102.

Pursuant to W.S. 16-6-203, Wyoming labor shall be used on this project except other laborers may be used when Wyoming laborers are not available for the employment from within the state or are not qualified to perform the work involved. For further details see W.S. 16-6-201 through -206.

Pursuant to W.S. 16-6-121, Contractor is hereby provided written notice of the following:

> (a) Any subcontractor or materialman entitled to the protection of a bond or other form of guarantee approved by a public entity under W.S. 16-6-112 shall give notice of his right to that protection to the general contractor. Failure to give notice to a general contractor who has complied with subsections (f) and (g) of this section waives the subcontractor or materialman's protection under the bond or guarantee.
>
> (b) The notice shall be given no later than sixty (60) days after the date on which services or materials are first furnished.
>
> (c) The notice shall be sent to the general contractor by certified mail, electronic means or delivered to and receipted by the general contractor or his agent. Notice by certified mail or electronic means is effective on the date the notice is mailed or sent electronically.
>
> (d) The notice shall be in writing and shall state that it is a notice of a right to protection under the bond or guarantee. The notice shall be signed by the subcontractor or materialman and shall include the following information:
>
> > (i) The subcontractor or materialman's name, address and phone number and the name of a contact person;
> >
> > (ii) The name and address of the subcontractor's or materialman's vendor; and
> >
> > (iii) The type or description of the materials or services provided.
>
> (e) This section shall only apply where the general contractor's contract is for an amount exceeding one hundred fifty thousand dollars ($150,000.00).
>
> (f) The general contractor shall post on the construction site a prominent sign citing this section and stating that any subcontractor or materialman shall give

notice to the general contractor of a right to protection under the bond or guarantee and that failure to provide the notice shall waive the subcontractor or materialman's protection under the bond or guarantee.

(g) The owner or his agent shall provide written notice of the information required by this section in the project specifications.

If Owner is a municipality or is a joint powers board wherein at least one member is a municipality, the following applies:

Pursuant to W.S. 15-1-113(p), the provisions of W.S. 15-1-113 are part of this contract.

DAVIS BACON PREVAILING WAGE REQUIREMENTS

Federal Labor Standards Provisions (from 29 CFR 5.5)

§ 5.5 Contract provisions and related matters.

(a) ***Required contract clauses.*** …

(1) ***Minimum wages*** —

(i) ***Wage rates and fringe benefits.*** All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of this section, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(v) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed,

without regard to skill, except as provided in paragraph (a)(4) of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (a)(1)(iii) of this section) and the Davis-Bacon poster (WH-1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii) ***Frequently recurring classifications.***

(A) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph (a)(1)(iii) of this section, provided that:

(*1*) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(*2*) The classification is used in the area by the construction industry; and

(*3*) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(B) The Administrator will establish wage rates for such classifications in accordance with paragraph (a)(1)(iii)(A)(*3*) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

(iii) ***Conformance.***

(A) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(*1*) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(*2*) The classification is used in the area by the construction industry; and

(*3*) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(C) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to *DBAconformance@dol.gov*. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to *DBAconformance@dol.gov,* refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(E) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs (a)(1)(iii)(C) and (D) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph (a)(1)(iii)(C) or (D) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iv) ***Fringe benefits not expressed as an hourly rate.*** Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(v) ***Unfunded plans.*** If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide

fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(vi) ***Interest.*** In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

(2) ***Withholding*** —

(i) ***Withholding requirements.*** The Owner or the Wyoming SRF Program may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in paragraph (a) of this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work (or otherwise working in construction or development of the project under a development statute) all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph (a)(3)(iv) of this section, the Wyoming SRF Program may on its own initiative and after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(ii) ***Priority to withheld funds.*** The Department has priority to funds withheld or to be withheld in accordance with paragraph (a)(2)(i) or (b)(3)(i) of this section, or both, over claims to those funds by:

(A) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(B) A contracting agency for its reprocurement costs;

(C) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(D) A contractor's assignee(s);

(E) A contractor's successor(s); or

(F) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901-3907.

(3) ***Records and certified payrolls*** —

(i) ***Basic record requirements*** —

(A) ***Length of record retention.*** All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(B) ***Information required.*** Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(C) ***Additional records relating to fringe benefits.*** Whenever the Secretary of Labor has found under paragraph (a)(1)(v) of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(D) ***Additional records relating to apprenticeship.*** Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

(ii) ***Certified payroll requirements*** —

(A) ***Frequency and method of submission.*** The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the Owner for transmission to the Wyoming SRF Program upon request. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(B) ***Information required.*** The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph (a)(3)(i)(B) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.,* the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH-347 or in any other format desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division website at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the sponsoring government agency (or the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records).

(C) ***Statement of Compliance.*** Each certified payroll submitted must be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(*1*) That the certified payroll for the payroll period contains the information required to be provided under paragraph (a)(3)(ii) of this section, the appropriate information and basic records are being maintained under paragraph (a)(3)(i) of this section, and such information and records are correct and complete;

(*2*) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3; and

(*3*) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(D) ***Use of Optional Form WH-347.*** The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 will satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(C) of this section.

(E) ***Signature.*** The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(F) ***Falsification.*** The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

(G) ***Length of certified payroll retention.*** The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

(iii) ***Contracts, subcontracts, and related documents.*** The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

(iv) ***Required disclosures and access*** —

(A) ***Required record disclosures and access to workers.*** The contractor or subcontractor must make the records required under paragraphs (a)(3)(i) through (iii) of this section, and any other documents that the Wyoming SRF Program or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the Wyoming SRF Program or the Department of Labor, and must permit such representatives to interview

workers during working hours on the job.

(B) ***Sanctions for non-compliance with records and worker access requirements.*** If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Wyoming SRF Program or Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(C) ***Required information disclosures.*** … the contractor, subcontractor, or both, must, upon request, provide the full Social Security number and last known address, telephone number, and email address of each covered worker to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the Wyoming SRF Program, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

(4) ***Apprentices and equal employment opportunity*** —

(i) ***Apprentices*** —

(A) ***Rate of pay.*** Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the

OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(B) ***Fringe benefits.*** Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(C) ***Apprenticeship ratio.*** The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph (a)(4)(i)(D) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph (a)(4)(i)(A) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(D) ***Reciprocity of ratios and wage rates.*** Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

(ii) ***Equal employment opportunity.*** The use of apprentices and journeyworkers under this part must be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) ***Compliance with Copeland Act requirements.*** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) ***Subcontracts.*** The contractor or subcontractor must insert in any subcontracts the clauses contained in paragraphs (a)(1) through (11) of this section, along with the applicable wage determination(s) and such other clauses or contract modifications as the Wyoming SRF Program may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in

any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate.

(7) ***Contract termination: debarment.*** A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) ***Compliance with Davis-Bacon and Related Act requirements.*** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) ***Disputes concerning labor standards.*** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) ***Certification of eligibility.***

(i) By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

(iii) The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

(11) ***Anti-retaliation.*** It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

(i) Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

(ii) Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any

right or protection under the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

(iii) Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or 29 CFR part 1 or 3; or

(iv) Informing any other person about their rights under the DBA, Related Acts, this part, or 29 CFR part 1 or 3.

(b) ***Contract Work Hours and Safety Standards Act (CWHSSA).*** … As used in this paragraph (b), the terms "laborers and mechanics" include watchpersons and guards.

(1) ***Overtime requirements.*** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) ***Violation; liability for unpaid wages; liquidated damages.*** In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $32 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1).

(3) ***Withholding for unpaid wages and liquidated damages*** —

(i) ***Withholding process.*** The Wyoming SRF Program may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this paragraph (b) on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract

Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

(ii) ***Priority to withheld funds.*** The Department has priority to funds withheld or to be withheld in accordance with paragraph (a)(2)(i) or (b)(3)(i) of this section, or both, over claims to those funds by:

(A) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(B) A contracting agency for its reprocurement costs;

(C) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(D) A contractor's assignee(s);

(E) A contractor's successor(s); or

(F) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901-3907.

(4) ***Subcontracts.*** The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs (b)(1) through (5) of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (5). In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

(5) ***Anti-retaliation.*** It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

(i) Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

(ii) Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any

right or protection under CWHSSA or this part;

(iii) Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

(iv) Informing any other person about their rights under CWHSSA or this part.

Compliance Verification by Owner and Other Information

1. Based on 29 CFR 5.6: Owner shall make such investigations as may be necessary to assure compliance with the labor standards provisions and related statutes and regulations. Investigations shall be made with such frequency as may be necessary to assure compliance. Such investigations shall include interviews with employees, which shall be taken in confidence, and examinations of payroll data and evidence of registration and certification with respect to apprenticeship and training plans. In making such examinations, particular care shall be taken to determine the correctness of classifications and to determine whether there is a disproportionate employment of laborers and of apprentices or trainees registered in approved programs. Such investigations shall also include evidence of fringe benefit plans and payments thereunder. Complaints of alleged violations shall be given priority.

2. Owner shall periodically interview a sufficient number of employees entitled to Davis Bacon prevailing wages (covered employees) to verify that contractors and subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6, all interviews must be conducted in confidence. Owner shall use Standard Form 1445 or equivalent forms to document interviews. Copies of the SF 1445 are available at https://www.gsa.gov/system/files/SF_1445.pdf or its successor website.

3. Owner shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with Davis Bacon posed by contractors and subcontractors and the duration of each contract/subcontract. At a minimum, Owner shall conduct interviews with a representative sample of covered employees from each classification of worker for each contractor and each subcontractor at least once each month during construction. Owner must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with Davis Bacon. Representative sample from each classification means at least one from each classification. If there are more than just a few workers in a classification, the representative sample shall include more than one interview each month for that classification. Owner shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence. Owner shall cross check the interviews against the payrolls.

4. Owner shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors and subcontractors are paying the appropriate wage rates. Owner shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with Davis Bacon posed by contractors and subcontractors and the duration of each contract/subcontract. At a minimum, Owner shall spot check payroll data within two weeks

of each contractor/subcontractor's submission of its initial payroll data, and two weeks prior to the completion date of the contract/subcontract, and at least monthly during construction. Owner must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with Davis Bacon. In addition, during the examinations Owner shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

5. Owner shall periodically review contractor's and subcontractors' use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of laborers, trainees, and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 3 and 4 above.

6. Owner must immediately report potential violations of the Davis Bacon prevailing wage requirements to the Wyoming SRF Program, the EPA Davis Bacon contact (Lindsey Phillips 303-312-7291), and to the appropriate DOL Wage and Hour District Office listed at http://www.dol.gov/whd/america2.htm.

7. Owner shall verify that the Davis Bacon poster and wage decisions are posted at the job site in a prominent and accessible place where both can be easily seen by the workers.

8. Owner shall verify that contractor and subcontractors are not listed as excluded from federally funded or assisted contracts at https://sam.gov/content/home.

9. Owner shall maintain the payrolls, interview records, and other compliance related records for a minimum of three years after completion of the contract and shall provide them upon request to the Wyoming SRF Program or to applicable federal agencies.

10. Additional compliance information and assistance is available at https://www.dol.gov/agencies/whd/government-contracts/construction/guidance and other related websites.

PROHIBITION ON CERTAIN TELECOMMUNICATION AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT

General:

This term and condition implements 2 CFR 200.216 and is effective for obligations and expenditures of EPA financial assistance funding on or after 8/13/2020.

As required by 2 CFR 200.216, EPA recipients and subrecipients, including borrowers under EPA funded revolving loan fund programs, are prohibited from obligating or expending loan or grant funds to procure or obtain; extend or renew a contract to procure or obtain; or enter into a

contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that use covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities). Recipients, subrecipients, and borrowers also may not use EPA funds to purchase:

a. For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

b. Telecommunications or video surveillance services provided by such entities or using such equipment.

c. Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

Consistent with 2 CFR 200.471, costs incurred for telecommunications and video surveillance services or equipment such as phones, internet, video surveillance, and cloud servers are allowable except for the following circumstances:

a. Obligating or expending EPA funds for covered telecommunications and video surveillance services or equipment or services as described in 2 CFR 200.216 to:

(1) Procure or obtain, extend, or renew a contract to procure or obtain;

(2) Enter into a contract (or extend or renew a contract) to procure; or

(3) Obtain the equipment, services, or systems.

Certain prohibited equipment, systems, or services, including equipment, systems, or services produced or provided by entities identified in section 889, are recorded in the System for Award Management exclusion list on **https://sam.gov/content/home**.

USE OF AMERICAN IRON AND STEEL

General:

All iron and steel products used in the project shall be produced in the United States, unless a waiver is provided by the United States Environmental Protection Agency (EPA).

The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

Production of iron or steel products in the United States requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating, and coating. Steel means an alloy that includes at least 50 percent iron and between 0.02 and 2 percent carbon and may contain other elements. Construction of precast concrete products must be performed in the United States.

International trade agreements have no effect on this provision for this contract. Local government entities, such as Owner, are not obligated under international trade agreements to treat foreign produced iron and steel the same as United States produced iron and steel.

See the following EPA website for further information and details on this requirement: http://water.epa.gov/grants_funding/aisrequirement.cfm.

Documentation:

Contractor shall collect American Iron and Steel (AIS) documentation for each iron and steel product used in the project. The documentation shall show that all production processes for each product occurred in the United States. Documentation shall show the manufacturer(s) involved in production of the product and the city and state where each process occurred. Copies of all AIS documentation shall be submitted to Engineer. This shall be submitted along with any other associated submittals for the products. If Contractor wishes to cover some iron and steel products under the EPA issued "De Minimus" waiver, Contractor shall collect the documentation required under that waiver and submit a copy to Engineer. Additional information, including example product certifications and the De Minimus waiver can be found at the above referenced EPA website.

Waivers:

EPA may grant a waiver if it determines that:

1. Applying the requirement would be inconsistent with the public interest,
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality, or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Owner is the entity that formally makes the request for a waiver, including requests that originate from Contractor or subcontractors or suppliers. EPA requires detailed supporting information to

evaluate a waiver request. See the above referenced EPA website for additional information on the waiver process. Owner shall send waiver requests, in the form of a Word document (.doc), along with all supporting documentation, to the Wyoming SRF program. The Wyoming SRF program will forward waivers to EPA. Send waiver requests to Greg Crocker for all CWSRF projects and to Jennifer Russell for all DWSRF projects.

EPA will make available to the public on an informal basis a copy of the waiver request and information available to the EPA concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. EPA shall make the waiver request and accompanying information available on the above referenced EPA website. If EPA grants a waiver, it will publish such waiver on that website.

DISADVANTAGED BUSINESS ENTERPRISE UTILIZATION

1. General

This project includes federal financial assistance in the form of a State Revolving Fund (SRF) loan. Owner and Contractor/Bidder are required to make good faith efforts with adequate documentation to include disadvantaged business enterprises (DBEs) as subcontractors or suppliers on this project. More detailed regulations are published under 40 CFR Part 33.

2. DBE Certification

DBEs include minority business enterprises (MBEs) and women's business enterprises (WBEs). MBEs and WBEs must be certified as such in order to participate as a DBE. Certification can be through the Wyoming Department of Transportation (WYDOT) under its DBE program, through the Small Business Administration (SBA) under its 8(a) Business Development Program or its Small Disadvantaged Business (SDB) Program, or through other valid government or private organizations. Please see the attached list of WYDOT certified DBE firms, current as of the date shown. WYDOT maintains their list of certified DBE firms on the internet at https://www.dot.state.wy.us/home/business_with_wydot/contractors/Disadvantaged_Business_Enterprise.html.

3. Good Faith Efforts

Owner and Contractor/Bidder must make the following good faith efforts when soliciting contractors, subcontractors, or suppliers to procure construction, equipment, services, and supplies on this project:

(a) Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local and Government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.

(b) Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

(c) Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, State, and local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

(d) Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

(e) Use the services and assistance of the SBA and the Minority Business Development Agency of the Department of Commerce.

(f) If the prime contractor awards subcontracts, require the prime contractor to take the steps in paragraphs (a) through (e) of this section.

4. Fair Share Objective

The Wyoming SRF Program has negotiated the following DBE fair share objective percentages with the United States Environmental Protection Agency:

MBE: Construction 3.9%, Supplies 6.3%, Services 4.6%, Equipment 3.5%

WBE: Construction 3.9%, Supplies 3.5%, Services 4.6%, Equipment 3.7%

These are goals, not quotas. The requirement is that Owner and Contractor/Bidder must make and document good faith efforts to solicit DBE participation.

5. Documentation for Bidder to Submit with Bid

(a) Contractor/Bidder shall submit the DBE Good Faith Effort Documentation form (use the form provided in these SRF Special Conditions). If requested, Bidder shall provide complete documentation for the Good Faith Efforts. **This form must be submitted even if no subcontractors will be used.**

(b) Contractor/Bidder shall submit its Bidders List with its bid, using the form provided. It shall include **all** entities that provided Contractor/Bidder a bid or quote on this project, whether or not the Bidder proposed to utilize the entity. It shall include both DBE and non-DBE bidders. Required information for each entity includes 1) entity's name and point of contact, 2) entity's mailing address, telephone number, and e-mail address, 3) procurement on which entity bid or quoted and when, and 4) entity's status as an MBE/WBE or non-MBE/WBE.

(c) Contractor/Bidder shall have each DBE subcontractor/supplier it proposes to use complete EPA Form 6100–3—DBE Program Subcontractor Performance Form and shall include all completed forms as part of the bid or proposal package. **This form is not needed if Contractor/Bidder has no DBE participation**.

(d) Contractor/Bidder shall complete and submit EPA Form 6100–4—DBE Program Subcontractor Utilization Form as part of the bid or proposal package. **This form is not needed if Contractor/Bidder has no DBE participation.**

6. Documentation for Owner to Submit to SRF Program Regarding Award of Construction Contract

Before awarding the contract, Owner shall submit the following items to the SRF program for approval:

(a) Bid Tabulation of all bids submitted, including total and itemized prices
(b) Owner's or Engineer's proposed recommendation regarding contract award.
(c) The bid and all documentation of the apparent successful bidder.
(d) A composite Bidders List. This shall be created from the separate lists submitted by the various Bidders with their bids.
(e) Affidavit of publication of the Advertisement for Bids

7. Other Requirements and Information

(a) Contractor must pay its subcontractors for satisfactory performance no more than 30 days from Contractor's receipt of payment from Owner.

(b) Contractor must notify Owner in writing prior to any termination of a DBE subcontractor for Contractor's convenience. Owner must pass such notification along to the Wyoming SRF program.

(c) If a DBE subcontractor fails to complete work under the subcontract for any reason, Contractor must employ the six good faith efforts listed above (3. Good Faith Efforts) if soliciting a replacement subcontractor.

(d) Contractor must employ the six good faith efforts listed above even if Contractor has achieved its fair share objectives.

(e) Contractor must provide EPA Form 6100– 2—DBE Program Subcontractor Participation Form to all of its DBE subcontractors. EPA Form 6100–2 gives a DBE subcontractor the opportunity to describe the work the DBE subcontractor received from the prime contractor, how much the DBE subcontractor was paid and any other concerns the DBE subcontractor might have, for example reasons why the DBE subcontractor believes it was terminated by the prime contractor. DBE subcontractors may send completed copies of EPA Form 6100–2 directly to the appropriate EPA DBE Coordinator. The EPA DBE Coordinator is Lindsay Seeger, phone (303) 312-6564, email seeger.lindsay@epa.gov.

(f) Copies of EPA Form 6100–2—DBE Program Subcontractor Participation Form, EPA Form 6100–3—DBE Program Subcontractor Performance Form, and EPA Form 6100–4—DBE Program Subcontractor Utilization Form may be obtained from EPA OSDBU's Home Page on the Internet or directly from EPA OSDBU. Copies of these forms are also included in these SRF Special Conditions.

(g) Contractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. Contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by Contractor to carry out these requirements is a material breach of this contract that may result in the termination of this contract or other legally available remedies.

(h) Bidders lists assembled from past SRF projects are available from the Wyoming SRF Program for Owner's or Contractor's/Bidder's information. Personnel and reproduction charges may apply.

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DBE Good Faith Effort Documentation

Project: _____

Bidder: _____ Bid date: _____

Bidder shall complete the checklist to certify that it has complied with the requirement to make good faith efforts to ensure that certified DBEs have the opportunity to compete for procurements funded by EPA financial assistance funds. Bidder shall make good faith efforts prior to submission of bid/proposal.

1. Did you ensure that DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities? ☐ Yes ☐ No

2. Did you make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process? ☐ Yes ☐ No

3. Did you consider in the contracting process whether firms competing for large contracts could subcontract with DBEs? This will include dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process. ☐ Yes ☐ No

4. Did you consider contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually? ☐ Yes ☐ No

5. Did you use the services and assistance of the SBA and the Minority Business Development Agency of the Department of Commerce? ☐ Yes ☐ No

Certification Regarding DBE Good Faith Effort

Bidder certifies, by submission of this form that it has fulfilled the Good Faith efforts required for this project. If requested, Bidder shall provide complete documentation for the Good Faith Efforts.

_____

Name and Title

_____

Signature Date

(page intentionally blank)

Bidders List

Project: _____

Owner: _____

Bid Date: _____

Contractor/Bidder should list itself first. Then list all entities that provided Contractor/Bidder a bid or quote on this project. Include all subcontractors and suppliers, both DBE and non-DBE, regardless of whether you propose to use them. Add additional sheets as necessary.

Bidding entity name:
Contact person name:
Mailing address:
Telephone:
E-mail:
Work bid: bid contract as prime
Status: ___MBE ___WBE ___non-DBE

Bidding entity name:
Contact person name:
Mailing address:
Telephone:
E-mail:
Work bid:
Status: ___MBE ___WBE ___non-DBE

Bidding entity name:
Contact person name:
Mailing address:
Telephone:
E-mail:
Work bid:
Status: ___MBE ___WBE ___non-DBE

Bidding entity name:
Contact person name:
Mailing address:
Telephone:
E-mail:
Work bid:
Status: ___MBE ___WBE ___non-DBE

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Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE[1] subcontractor[2] the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name	Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity:	

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services, Equipment or Supplies	Amount Received by Prime Contractor

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-2 (DBE Subcontractor Participation Form)

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

Please use the space below to report any concerns regarding the above EPA-funded project:

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-2 (DBE Subcontractor Participation Form)

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

This form is intended to capture the DBE[1] subcontractor's[2] description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name		Project Name
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Prime Contractor Name		Issuing/Funding Entity:

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services , Equipment or Supplies	Price of Work Submitted to the Prime Contractor
DBE Certified By: ___ DOT ___ SBA ___ Other: _____	Meets/ exceeds EPA certification standards? ___ YES ___ NO ___ Unknown	

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-3 (DBE Subcontractor Performance Form)

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-3 (DBE Subcontractor Performance Form)

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE[1] subcontractors[2] and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name	Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Issuing/Funding Entity:		

I have identified potential DBE certified subcontractors	___ YES	___ NO
If yes, please complete the table below. If no, please explain:		

Subcontractor Name/ Company Name	Company Address/ Phone/ Email	Est. Dollar Amt	Currently DBE Certified?

Continue on back if needed

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-4 (DBE Subcontractor Utilization Form)

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-4 (DBE Subcontractor Utilization Form)

Wyoming SRF DBE Directory
Alphabetical Listing
January, 2026

The information within the directory is not a guarantee of the DBE's capacity and ability to perform work. This list is the most current list available to the SRF program of once certified DBEs. It may be utilized to meet the EPA Six Good Faith Efforts and does not represent any current DOT or other agency certified DBEs.

A&E Caulking Solutions | Edward Collins | Minority Male Owned/Hispanic

14959 Laurel Ave.
Omaha, NE 68116-3788

Phone: (402)237-7931
Fax:
Email: andrew@aecaulkingsolutions.com

Contractor # 03884
Website: www.aecaulkingsolutions.com

Business Description:

Work Code	Description
238390	Other Building Finishing Contractors

Advanced Traffic Services, LLC | Duran Hill | Minority Male Owned/Black

2323 S. Troy Street, Bldg. 1 Suite 300A
Aurora, CO 80014

Phone: (720)328-3952
Fax: (303)353-4567
Email: advancedtrafficservicesllc@gmail.com

Contractor # 03721
Website: https://www.advancedtrafficteam.com

Business Description: Traffic control, construction sign installation, flagging, channeling devices (i.e. vertical panels, barrels, cones, tubular markers, pilot vehicle and temporary attenuators). www.advancedtrafficteam.com

Work Code	Description
561990	Flagging (i.e., traffic control) Services
237310	Sign Erection, Highway, Roads Street or Bridge

Aggregate Logistics, LLC | Toni Castiglioni | Non-Minority Woman Owned/Non-Minority Women

PO Box 393
Timnath, CO 80547
Physical: 1824 Windfall Drive

Phone: (720)421-5222
Fax:
Email: tonicastiglioni@yahoo.com

Contractor # 03753
Website: www.AggregateLogistics.com

Business Description: Dealer/Supplier- Aggregate, Landscape Materials, Erosion Control Materials, Concrete

Work Code	Description
212321	Construction Sand & Gravel Mining
444190	Other Building Material Dealers
423390	Other Construction Material Merchant Wholesalers
484230	Specialized Freight (except used goods) Trucking, Long-Distance

Alexander Construction Co. | Lorinda Hale | Non-Minority Woman Owned/Non-Minority Women

PO Box 24
Wheatland, WY 82201
Physical: 149 Y-O Ranch Rd

Phone: (307)322-2278
Fax: (307)322-2278
Email: lhale_alex@yahoo.com

Contractor # 02777
Website:

Business Description: Grading; milling; surfacing; truck haul; landscaping; concrete curb and gutter; sidewalks; box culverts; fencing; water lines.

Work Code	Description
237310	Asphalt Paving (i.e., highway, road, street, public sidewalk)
237310	Concrete Paving (i.e., highway, road, street, public sidewalk)
212321	Construction Sand & Gravel Mining
238990	Fencing Contractors (except electronic containment fencing for pets)
238910	Grading Construction Sites
561730	Landscaping Services
212319	Other Crushed and Broken Stone Mining and Quarrying
484220	Specialized Freight (except used goods) Trucking, Local

Allsource Construction Supply	Debra Rockway	Non-Minority Woman Owned/Non-Minority Women
P.O. Box 30898 Portland, OR 97294 Physical: 327 SE Yamhill St.	Phone: (503)858-8922 Fax: Email: debbier@asupply.net	Contractor # 03758 Website:

Business Description: Concrete building products, weather barrier, first aid and safety equipment and supplies, wire and supplies, coaxial cable, electrical construction material, plumbing fittings and valves, ladders, sealants, and sales of hardware including small tools and safety equipment.

Work Code	Description
423320	Brick, Stone, and Related Construction Material Merchant Wholesalers
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers
423710	Hardware Merchant Wholesalers
423840	Industrial Supplies Merchant Wholesalers
444190	Other Building Material Dealers
424690	Other Chemical and Allied Products Merchant Wholesalers
423390	Other Construction Material Merchant Wholesalers
423330	Roofing, Siding, and Insulation Material Merchant Wholesalers
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers

Asphalt Plus, Inc.	Melinda Oedekoven	Non-Minority Woman Owned/Non-Minority Women
425 Johnson Lane Billings, MT 59101	Phone: (406)248-5609 Fax: (406)248-5609 Email: office@asphaltplusinc.com	Contractor # 03598 Website:

Business Description: Civil construction - paving, concrete, gravel/dirt work, and excavating. www.asphaltplusinc.com

Work Code	Description
238990	All Other Specialty Trade Contractors
237310	Asphalt Paving (i.e., highway, road, street, public sidewalk)
237310	Concrete Paving (i.e., highway, road, street, public sidewalk)
238910	Excavation Contractors
237310	Highway, Street, and Bridge Construction

Atlantic Petroleum and Mineral Resources, Inc,	Anthony Ndah	Minority Male Owned/Black
1445 North Loop W Houston, TX 77008	Phone: (713)223-2767 Fax: Email: andah@atlanticpetro.com	Contractor # 03746 Website:

Business Description: Atlantic is engaged in the sale, marketing, and distribution of fuels, lubricants, chemicals and services to automotive, industrial, commercial, construction, and agricultural consumers. Provides inspection, analysis, management, collection, and solutions for hazardous waste.

Work Code	Description
541620	Environmental Consulting Services
562112	Hazardous Waste Collection
562211	Hazardous Waste Treatment and Disposal
562219	Other Nonhazardous Waste Treatment and Disposal
488490	Other Support Activities for Road Transportation
424720	Petroleum and Petroleum Products Merchant Wholesalers (except bulk stations and terminals)
56221	Waste Treatment and Disposal

B & B Enterprises, LLC	Bart Dale	Minority Male Owned/Native American
505 E. Washington Ave. Riverton, WY 82501	Phone: (307)856-0703 Fax: (307)856-0711 Email: bboffice22@gmail.com	Contractor # 03592 Website:

Business Description: Signing, aggregate and crushing.

Work Code	Description
423320	Brick, Stone, and Related Construction Material Merchant Wholesalers
212321	Construction Sand & Gravel Mining
561990	Flagging (i.e., traffic control) Services
212319	Other Crushed and Broken Stone Mining and Quarrying
237310	Sign Erection, Highway, Roads Street or Bridge

B. Fritch Trucking	Bill Fritch	Minority Male Owned/Asian Pacific

8418 W. Pocatello Creek Road Pocatello, ID 83201	Phone: (208)233-7076 Fax: (208)233-7076 Email: barwill@hotmail.com	Contractor # 03163 Website:

Business Description: Truck haul of gravel, asphalt, riprap and dirt.

Work Code	Description
238910	Excavation Contractors
238910	Site Preparation Contractors
484220	Specialized Freight (except used goods) Trucking, Local

Barnum, Inc.	Jerrica Mittleider	Non-Minority Woman Owned/Non-Minority Women
183 US Highway 16 East Buffalo, WY 82834	Phone: (307)684-5365 Fax: (307)684-5766 Email: jerrica@barnuminc.com;wendi@barnuminc.com	Contractor # 03268 Website:

Business Description: Excavation and grading contractor, trucking and aggregates roust about (oil & gas), coal bed methane, reclamation

Work Code	Description
238910	Excavation Contractors
238130	Framing Contractors
237310	Highway, Street, and Bridge Construction
237120	Oil and Gas Pipeline and Related Structures Construction
238190	Other Foundation, Structure, and Building Exterior Contractors
238110	Poured Concrete Foundation and Structure Contractors
237130	Power and Communication Line and Related Structures Construction
238910	Site Preparation Contractors
238120	Structural Steel and Precast Concrete Contractors
237110	Water and Sewer Line and Related Structures Construction

BD Hauling Inc.	Brittany Bieker	Non-Minority Woman Owned/Non-Minority Women
403 Evans Dr. Idaho Falls, ID 83402	Phone: (208)589-9528 Fax: Email: bdhaulin@gmail.com	Contractor # 03801 Website:

Business Description: Trucking of local construction material, transportation of heavy haul equipment and contractor for small construction jobs. Dump trucking, gravel hauling, sand hauling, oil and gas field equipment trucking

Work Code	Description
484220	Specialized Freight (except used goods) Trucking, Local

Black Iron Steel, LLC dba Black Iron Rebar, LLC	Kacie Hertz	Minority Woman Owned/Black
14610 Basin Dr. Colorado Springs, CO 80908	Phone: (626)376-5228 Fax: Email: blackironkacie@gmail.com	Contractor # 03862 Website:

Business Description: BLACK IRON STEEL, LLC, PROVIDES MANPOWER FOR REINFORCING STEEL (REBAR) INSTALLATION FOR COMMERCIAL, INDUSTRIAL, HIGHWAY AND INFRASTRUCTURE PROJECTS IN COLORADO, ARIZONA, AND WYOMING.

Work Code	Description
238120	Structural Steel and Precast Concrete Contractors

CENTENNIAL TRUCKING, INC.	Haley Peck	Non-Minority Woman Owned/Non-Minority Women
1058 N Geneva Rd Orem, UT 84057	Phone: (801)368-5986 Fax: Email: centennialtrucking@gmail.com	Contractor # 03866 Website:

Business Description: Trucking (hauling)

Work Code	Description
238990	All Other Specialty Trade Contractors

Coating Specialist, LLC	Dora Vigil	Minority Woman Owned/Hispanic
6340 Sayres Rd. Colorado Springs, CO 80927	Phone: (970)567-0357 Fax:	Contractor # 03763 Website:

Email: brittany@coatingspecialist.com

Business Description: Coatings and waterproofing contractor.

Work Code	Description
238320	Bridge painting
238390	Concrete coating, glazing or sealing
238320	Painting (except roof) contractors
237310	Resurfacing, Highway, Road, Street, Bridge or Airport Runway
238390	Sandblasting, building exterior
238390	Waterproofing contractors

COLDWATER GROUP, INC. | Matt Montano | Minority Male Owned/Hispanic

1452 W Stone Field Way B3
Pleasant View, UT 84414

Phone: (801)823-9493
Fax:
Email:
matt@coldwaterinc.com;chad@coldwaterinc.com

Contractor # 03713
Website:

Business Description: Bridge rehab, Bridge overlays & membranes, Bridge joint repair, minor structural concrete, minor structures.

Work Code	Description
237310	Highway, Street, and Bridge Construction

Comers Concrete, LLC | Jessica Brownlow | Non-Minority Woman Owned/Non-Minority Women

873 S. Orem Blvd. Ste 2
Orem, UT 84058

Phone: (801)225-4444
Fax: (801)841-3573
Email: jessica@comersconcrete.com

Contractor # 03538
Website: www.comersconcrete.com

Business Description: Concrete and bridges. www.comersconcrete.com

Work Code	Description
238110	Poured Concrete Foundation and Structure Contractors

Contractor Services Inc | Rocky Torres | Minority Male Owned/Hispanic

1320 East 8th Street
North Platte, NE 69101

Phone: (308)221-2372
Fax: (308)221-2572
Email:
Rocky@csitraffic.com;eddie@csitraffic.com;theresa@csitraffic.com

Contractor # 03737
Website:

Business Description: Traffic control, barricades, concrete barriers, pavement markings, water blasting, signs and painting. www.csitraffic.com

Work Code	Description
238990	All Other Specialty Trade Contractors
561990	Flagging (i.e., traffic control) Services
488490	Other Support Activities for Road Transportation
237310	Painting Lines on Highways, Streets and Bridges
237310	Parking Lot Marking and Line Painting
237310	Sign Erection, Highway, Roads Street or Bridge

Crossroads Highway Products, LLC | Stephanie M. Duncan | Non-Minority Woman Owned/Non-Minority Women

236 E Washington Street
Mooresville, IN 46158

Phone: (317)960-4050
Fax:
Email: sduncan@crossroadshighway.com

Contractor # 03878
Website:

Business Description:

Work Code	Description
424690	Adhesives for Bridge Related Construction and Repair
423320	Brick, Stone, and Related Construction Material Merchant Wholesalers
423320	Concrete Mixtures
237310	Highway, Street, and Bridge Construction
424690	Other Chemical and Allied Products Merchant Wholesalers
423390	Other Construction Material Merchant Wholesalers
425120	Wholesale Trade Agents and Brokers

Eagle Rock Timber, Inc.	Rick Gokey	Minority Male Owned/Native American
3000 N. Wright Road Idaho Falls, ID 83401	Phone: (208)529-4925 Fax: (208)523-2818 Email: ert@eaglerocktimber.com	Contractor # 02316 Website:

Business Description: Highway and road construction including grading, commercial/residential building and remodel, excavation and trenching, trucking of heavy equipment and large commodities, underground utilities, reforestation, wetlands remediation, landscaping, land clearing, steel building erection and finish, forming and pouring concrete structures, metal fabrication, and demolition of a variety of structures. www.eaglerocktimber.com

Work Code	Description
236220	Commercial and Institutional Building Construction
237310	Highway, Street, and Bridge Construction
238110	Poured Concrete Foundation and Structure Contractors
238910	Site Preparation Contractors
238120	Structural Steel and Precast Concrete Contractors
237110	Water and Sewer Line and Related Structures Construction

Entitlement & Engineering Solutions, Inc.	Amanda O'Connor	Non-Minority Woman Owned/Non-Minority Women
3801 E. Florida Ave. Ste. 425 Denver, CO 80210	Phone: (303)572-7997 Fax: (303)805-2043 Email: amanda.oconnor@ees.us.com	Contractor # 03602 Website:

Business Description: Civil engineering design, entitlement assistance, engineering consulting. www.ees.us.com

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541990	All Other Professional, Scientific, and Technical Services
541330	Civil Engineering Services

G & L Concrete, Inc.	Lisa Young	Non-Minority Woman Owned/Non-Minority Women
P.O. Box 488 Torrington, WY 82240 Physical: 6828 Road 47	Phone: (307)532-3129 Fax: (307)532-2973 Email: glconcrete123@gmail.com	Contractor # 02996 Website:

Business Description: Ready-mix concrete and pre-cast products

Work Code	Description
327320	Ready-Mix Concrete Manufacturing

Geranios Enterprises, Inc.	Linda Geranios	Minority Woman Owned/Hispanic
P.O. Box 2543 Great Falls, MT 59403 Physical: 320 1/2 Central Avenue	Phone: (406)727-3430 Fax: (406)727-8133 Email: om@g-e-inc.com	Contractor # 03610 Website:

Business Description: Site and utility work/excavating; concrete work

Work Code	Description
238990	All Other Specialty Trade Contractors
237310	Highway, Street, and Bridge Construction
237990	Other Heavy and Civil Engineering Construction
238110	Poured Concrete Foundation and Structure Contractors

Gil's Sales Co. Inc. dba GSC Lighting & Supply	Anna Pena-Roberts	Minority Woman Owned/Hispanic
16506 Cornerstone Drive Belton, MO 64012	Phone: (816)322-6999 Fax: (816)322-8169 Email: annaroberts@gsclighting.com	Contractor # 03676 Website:

Business Description: Electrical material supplier. www.gsclighting.com

Work Code	Description
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers
444190	Other Building Material Dealers

Guytec Steel Inc.	Casel Sattar	Minority Male Owned/Asian Indian

1106 Wyckoff Avenue Ridgewood, NY 11385	Phone: (718)821-3500 Fax: 7188213700;http://www.guyte(cst)eel-.com Email: bob@guytecsteel.com	Contractor # 03846 Website:

Business Description: Supply fabrication Install structural steel Install miscellaneous Steel.

Work Code	Description
238390	Concrete coating, glazing or sealing
332312	Fabricated Structural Metal Manufacturing
541611	Strategic Planning Consulting Services
238120	Structural Steel and Precast Concrete Contractors

Haass Construction Co., Inc.	Colleen Haass	Non-Minority Woman Owned/Non-Minority Women
1302 East C Street Casper, WY 82602	Phone: (307)265-9064 Fax: (307)266-4301 Email: colleen@haassconstruction.com	Contractor # 00981 Website:

Business Description: General construction including remodeling, cabinetmaking and additions, roofs, concrete surfacing and miscellaneous concrete work, www.haassconstruction.com

Work Code	Description
236220	Commercial and Institutional Building Construction
238110	Poured Concrete Foundation and Structure Contractors

Hardrives Construction, Inc.	James Bailey	Minority Male Owned/Asian Pacific
PO Box 2535 Billings, MT 59106 Physical: 2908 S. 64th St. W	Phone: (406)850-3047 Fax: (406)245-8834 Email: Jody@hardrives-asphalt.com	Contractor # 02192 Website:

Business Description: Asphalt surfacing, grading, sealcoating and crackfilling. www.hardrives-asphalt.com

Work Code	Description
238990	All Other Specialty Trade Contractors
237310	Asphalt Paving (i.e., highway, road, street, public sidewalk)
237310	Grading, Highway, Road, Street and Airport Runway
237310	Highway, Street, and Bridge Construction
238910	Site Preparation Contractors

Harmony Design, Inc.	Jennifer Zung	Minority Woman Owned/Asian Pacific
P.O. Box 369 Driggs, ID 83422 Physical: 18 N. Main, Suite 305	Phone: (208)354-1331 Fax: Email: jen.zung@harmonydesigninc.com	Contractor # 03332 Website: https://www.harmonydesigninc.com/

Business Description: Civil and structural engineering, landscape architecture, planning, GIS, and water resources. www.harmonydesigninc.com

Work Code	Description
541330	Engineering Services
541320	Landscape Architectural Services
541690	Other Scientific and Technical Consulting Services
541370	Surveying and Mapping (except geophysical) Services

Hudson, Inc.	Patty Hudson	Non-Minority Woman Owned/Non-Minority Women
P.O. Box 30272 Edmond, OK 73003	Phone: (405)348-9335 Fax: Email: patty@hudsonincorporated.com	Contractor # Website:

Business Description: Cold milling pavement: Concrete and Asphalt Removal; Diamond grinding; Grooving; Proilograph

Work Code	Description
237310	Highway, Street, and Bridge Construction

Hudspeth and Associates Inc	Gretl Pineda	Minority Woman Owned/Native American
1501 W Fountainhead Parkway Suite 550 Tempe, AZ 58282	Phone: (303)791-5562 Fax: (303)791-5780 Email: gretl.pineda@asrcindustrial.com	Contractor # 03196 Website: www.hudspethinc.com

Business Description:

Work Code	Description
332420	Metal Tank (Heavy Gauge) Manufacturing
237990	Other Heavy and Civil Engineering Construction
562910	Remediation Services
236118	Residential Remodelers
238910	Site Preparation Contractors
237110	Water and Sewer Line and Related Structures Construction

Hydro Logic, LLC | Carla Rumsey | Non-Minority Woman Owned/Non-Minority Women

P.O. Box 207
Buffalo, WY 82834
Physical: 191 Hazelton Rd

Phone: (307)217-6223
Fax:
Email: crumsey@hydrologicusa.com

Contractor # 03489
Website:

Business Description: Wetland deliniation, mitigation design and monitoring; planting/seeding; topgraphic surveys; stream restoration; analysis; hydrology studies. www.hydrologicusa.com

Work Code	Description
541620	Environmental Consulting Services
561730	Hydroseeding Services (e.g., decorative, erosion control purposes)
541690	Other Scientific and Technical Consulting Services
115112	Soil Preparation, Planting, and Cultivating

Idaho Traffic Safety, Inc. | Jennifer Lindstrom | Non-Minority Woman Owned/Non-Minority Women

3400 East Sunnyside Dr
Ammon, ID 83406

Phone: (208)522-4470
Fax: (208)522-6521
Email: jennifer@idahotrafficsafety.com

Contractor # 00868
Website:

Business Description: Rent and sell traffic control equipment; supply traffic control services; paint roads, parking lots, and airports. www.idahotrafficsafety.com

Work Code	Description
561990	Flagging (i.e., traffic control) Services
423990	Other Miscellaneous Durable Goods Merchant Wholesalers
237310	Painting Lines on Highways, Streets and Bridges

Intermountain Builders | Steve Espinosa | Minority Male Owned/Hispanic

P.O. Box 173
Lander, WY 82520
Physical: 240 Mortimore Lane

Phone: (307)332-6119
Fax: (307)332-6119
Email: intermountainbuilders@wyoming.com

Contractor # 02214
Website:

Business Description: Concrete surfacing including flatwork, slope protection, irrigation structures, pipe cutoffs, etc; general building construction including frame and metal buildings. NOTE: Please fax requests rather than email at this time.

Work Code	Description
237310	Asphalt Paving (i.e., highway, road, street, public sidewalk)
237310	Concrete Paving (i.e., highway, road, street, public sidewalk)
237310	Highway, Street, and Bridge Construction

JBI Trucking, LLC | Jesus Castillo | Minority Male Owned/Hispanic

8835 Country Creek Trail
Colorado Springs, CO 80924

Phone: (970)319-1293
Fax:
Email: 78gaby@live.com

Contractor # 03577
Website:

Business Description: Haul trucking - dirt, sand, gravel, rip rap, aggregate

Work Code	Description
484220	Specialized Freight (except used goods) Trucking, Local

K & S Brady Construction LLC | Kelly Brady | Non-Minority Woman Owned/Non-Minority Women

POB 1981 Minot, ND 58702
Minot, ND 58703
Physical: 5701 26th Avenue NW

Phone: (701)500-0959
Fax:
Email: kbrady60@hotmail.com

Contractor #
Website:

Business Description: Reseeding, fences, mulching, curlex, chain link fences, erosion control

Work Code	Description
238990	All Other Specialty Trade Contractors
238990	Fencing Contractors (except electronic containment fencing for pets)
561730	Landscaping Services

K's Construction, Inc.	Kathy Galloway	Non-Minority Woman Owned/Non-Minority Women
P.O. Box 1613 Afton, WY 83110 Physical: 441 Teemont Dr	Phone: (307)762-3516 Fax: (855)373-7621 Email: katgal2007@msn.com	Contractor # 02122 Website:

Business Description: Guard and bridge rail, fence, minor concrete structures, cattleguards, minor dirt work.

Work Code	Description
238990	Fencing Contractors (except electronic containment fencing for pets)
237310	Guardrail Construction
237310	Highway, Street, and Bridge Construction

King Enterprises	April Hegge	Non-Minority Woman Owned/Non-Minority Women
164 Progress Circle Mills, WY 82644 Physical: P.O. Box 1416	Phone: (307)235-4610 Fax: (307)265-6975 Email: info@kavcattle.com;april@kavcattle.com	Contractor # 02478 Website:

Business Description: Fence construction, general contracting, manufactured home installation.

Work Code	Description
238990	Fencing Contractors (except electronic containment fencing for pets)
237310	Guardrail Construction
237310	Highway, Street, and Bridge Construction
237310	Sign Erection, Highway, Roads Street or Bridge

Kirk Barnes Construction, Inc.	Kirk Barnes	Minority Male Owned/Native American
PO Box 656 Valentine, NE 69201 Physical: 1007 Jenny St.	Phone: (402)376-2723 Fax: (402)376-3013 Email: cc@kbcconst.com	Contractor # 02791 Website:

Business Description: Concrete flat work, joint sawing and sealing, carpentry, steel buildings

Work Code	Description
238990	All Other Specialty Trade Contractors
423320	Brick, Stone, and Related Construction Material Merchant Wholesalers
237310	Highway, Street, and Bridge Construction
236210	Industrial Building Construction
561730	Landscaping Services
237990	Other Heavy and Civil Engineering Construction
488490	Other Support Activities for Road Transportation
238910	Site Preparation Contractors
238120	Structural Steel and Precast Concrete Contractors

Koppel Fabrication, Inc.	Carrie Guier	Non-Minority Woman Owned/Non-Minority Women
10262 Hwy 127 Sweet Springs, MO 65351	Phone: (660)335-4601 Fax: Email: carrie@koppelfab.com	Contractor # 03687 Website: koppelfab.com

Business Description: Custom fabrication, specializing in constructing pedestrian rail, bridge-rail, handrail, ornamental fence, stairs, mezzanines, bus shelters and light structural applications. www.koppelfab.com

Work Code	Description
237310	Highway, Street, and Bridge Construction
332323	Ornamental and Architectural Metal Work Manufacturing

Lark Environmental, Inc.	Kara Mulvhill	Non-Minority Woman Owned/Non-Minority Women
P.O Box 654 Casper, WY 82636 Physical: 8533 Cole Creek Road	Phone: (307)429-2134 Fax: Email:	Contractor # 03822 Website: www.larkenv.com

KMulvihill@larkenv.com;jmcnutt@larkenv.com

Business Description: Lark is an environmental consulting firm specializing in NEPA, regulatory compliance, ecological studies/analyses, biological assessments & biological evaluations, resource management plans, public & stakeholder involvement, and tribal community coordination for local, state, and federal agencies and sovereign tribal nations throughout the Great Plains and Rocky Mountains.

Work Code	Description
541990	All Other Professional, Scientific, and Technical Services
541620	Environmental Consulting Services
561110	Office Administrative Services

Laura A. Wiedewitsch Trucking, LLC	Laura Wiedewitsch	Non-Minority Woman Owned/Non-Minority Women
PO Box 106 Vale, SD 57788 Physical: 19500 SD Hwy 79	Phone: (605)490-5644 Fax: Email: wied28@yahoo.com	Contractor # 03709 Website:

Business Description: Providing transportation services in the construction/aggregate industry.

Work Code	Description
484220	Specialized Freight (except used goods) Trucking, Local

LYNX, LLC	Doreen Horn	Non-Minority Woman Owned/Non-Minority Women
4092 E 450 N Rigby, ID 83442	Phone: (208)403-2554 Fax: Email: doreen.drivelynx@gmail.com	Contractor # 03842 Website:

Business Description: Aggregate, Dirt and Water, Long and Short Hauling.

Work Code	Description
484110	General Freight Trucking, Local
484220	Specialized Freight (except used goods) Trucking, Local

North American Safety Products, Inc.	Nicole Pfeiffer	Non-Minority Woman Owned/Non-Minority Women
9835 Clearvue Court Mokena, IL 60448	Phone: (800)475-6946 Fax: (815)469-2131 Email: nicole@naspinc.com	Contractor # 03704 Website: www.naspinc.com

Business Description: Manufacturer of safety barricades, gates and traffic control equipment. www.naspinc.com

Work Code	Description
332999	All Other Miscellaneous Fabricated Metal Product Manufacturing
332323	Ornamental and Architectural Metal Work Manufacturing
334290	Other Communications Equipment Manufacturing

NORTH/WESTERN ELECTRICAL CORPORATION OF COLORADO	Enrique Vera	Minority Male Owned/Hispanic
P.O. Box 33875 Northglenn, CO 80233 Physical: 10825 Irma Drive	Phone: (303)452-8576 Fax: (303)452-0255 Email: admin@northwesternelec.com;admin@northwesternelec.com	Contractor # 03422 Website:

Business Description: Electrical contractor

Work Code	Description
238210	Electrical Contractors and Other Wiring Installation Contractors
237130	Power and Communication Line and Related Structures Construction
237110	Water and Sewer Line and Related Structures Construction

NPW Contracting, Inc. dba HJR Supply, Inc.	Helen Madden-Weiss	Non-Minority Woman Owned/Non-Minority Women
5055 E. 39th Avenue Denver, CO 80207	Phone: (303)571-5995 Fax: (303)571-5999 Email: helen@npwcontracting.com;Rachel@npwcontracting.com	Contractor # 03722 Website:

Business Description: Specialty Contractor: Sealants, coatings, highway/bridge/below-grade/above-grade waterproofing or dam-proofing, sheet waterproofing, architectural expansion joints, civil expansion joints, epoxy and urethane injections, structural and architectural patching, masonry repair, leak repair, tactile warning tile installation, engineer specified work, carbon fiber repair. Broker: Type III Bearings, strip seal expansion joints and modular expansion joints. Regular Dealer of Erosion Control Products: Silt fence, rock socks; coal tar paving, asphalt coating and adhesives and

sealants. www.npwcontracting.com

Work Code	Description
237310	Bridge Construction
238390	Other Building Finishing Contractors
444190	Other Building Material Dealers
423390	Other Construction Material Merchant Wholesalers
425120	Wholesale Trade Agents and Brokers

Nunn Utility Locating, LLC | Ily Nunn | Non-Minority Woman Owned/Non-Minority Women

2435 King Blvd. Suite 120
Casper, WY 82604

Phone: (307)377-0096
Fax:
Email: ilynunn@nulocating.com

Contractor # 03706
Website:

Business Description: Utility locating services, through the use of Ground Penetrating Radar and Electromagnetic Induction technologies. www.nulocating.com

Work Code	Description
561990	All Other Support Services

P & E Painting and Lead Removal | Pedro Sanchez | Minority Male Owned/Hispanic

P.O. Box 252
Frannie, WY 82423
Physical: 250 4th Street

Phone: (307)664-2248
Fax: (307)664-2233
Email: p_e.painting@yahoo.com

Contractor # 02987
Website:

Business Description: Structural steel painting, lead paint removal; fencing and guardrail.

Work Code	Description
238990	Fencing Contractors (except electronic containment fencing for pets)
237310	Guardrail Construction
238320	Painting and Wall Covering Contractors
237310	Painting Lines on Highways, Streets and Bridges

PAJARDO ELECTRIC CO., INC. | ENRIQUE PAJARDO | Minority Male Owned/Black

5315 Barbara Avenue
Baltimore, MD 21206

Phone: (410)485-9122
Fax:
Email: epajardo@hotmail.com

Contractor # 03868
Website: http://WWW.PAJARDOELECTRIC.COM

Business Description: 38210 - Electrical Contractors and Other Wiring Installation Contractors (SPECIFICALLY: ELECTRICAL INSTALLATION CONTRACTORS, CONSTRUCTION AND PROJECT MANAGEMENT); 423610 - Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers; 541350 - Building inspection services

Work Code	Description
541350	Building Inspection Services
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers
238210	Electrical Contractors and Other Wiring Installation Contractors
541712	Research and Development in the Physical, Engineering, and Life Sciences (except biotechnology)

Pavement Solutions, Inc. | Aaron Ruiz | Minority Male Owned/Hispanic

P.O. Box 1790
Queen Creek, AZ 85142
Physical: 35732 S. Creekside Lane

Phone: (480)254-2091
Fax: (480)840-3317
Email: timpavesol@gmail.com

Contractor # 03486
Website:

Business Description: Asphalt and concrete surfacing, grading and profiling.

Work Code	Description
237310	Asphalt Paving (i.e., highway, road, street, public sidewalk)
237310	Concrete Paving (i.e., highway, road, street, public sidewalk)

Pikes Peak Steel LLC | Glen Carter | Minority Male Owned/Hispanic

3550 Mark Dobling Blvd
Colorado Springs, CO 80907

Phone: (719)471-8811
Fax: (719)471-1328
Email: gcarter@pikespeaksteel.com

Contractor # 03729
Website: http://www.pikespeaksteel.com

Business Description: Fabrication/supplier of construction steel products

237310	Bridge Construction
332312	Fabricated Structural Metal Manufacturing
238990	Fencing Contractors (except electronic containment fencing for pets)
237310	Guardrail Construction
237310	Highway, Street, and Bridge Construction
332323	Ornamental and Architectural Metal Work Manufacturing
238190	Other Foundation, Structure, and Building Exterior Contractors
238120	Structural Steel and Precast Concrete Contractors
425120	Wholesale Trade Agents and Brokers

Preferred Construction Mgt Co., Inc.
Kyla Magnusson
Non-Minority Woman Owned/Non-Minority Women

1395 Route 23 Unit 7
Butler, NJ 07405
Phone: (973)853-6060
Fax: (973)853-4645
Email: alexis@pcmcompany.com
Contractor # 03901
Website: http://www.pcmcompany.com

Business Description: Construction management; cost estimating; value engineering support; Critical Path Method (CPM) scheduling; cost analysis claims analysis; plan specifications; building feasibility reviews; and project support services.

Work Code	Description
237310	Construction Management, Highway, Road, Street and Bridge
236210	Construction management, industrial building (except warehouses
237990	Construction management, mass transit
237110	Construction management, water and sewer line
236116	New Multifamily Housing Construction (except for-sale builders)
237120	Oil and Gas Pipeline and Related Structures Construction

Professional Landscaping, Inc.
Marie Grady
Non-Minority Woman Owned/Non-Minority Women

308 Ponderosa Trail
Cheyenne, WY 82009
Phone: (307)778-8106
Fax: (307)778-9622
Email: gbgrady2@aol.com
Contractor # 01665
Website:

Business Description: Seeding contractor.

Work Code	Description
561730	Hydroseeding Services (e.g., decorative, erosion control purposes)

Project Solutions, Inc.
Sandra Burns
Non-Minority Woman Owned/Non-Minority Women

505 Kansas City Street
Rapid City, SD 57701
Phone: (605)737-0377
Fax: (605)355-6961
Email: dbe@projectsolutionsinc.com
Contractor # 03883
Website: https://projectsolutionsinc.com

Business Description: Consultant - business, management, Construction inspection, specialty staffing

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541330	Engineering Services

Rhodes Rebar Detailing and Estimating LLC
Susan F. Rhodes
Non-Minority Woman Owned/Non-Minority Women

6464 W Northview St
Boise, ID 83704
Phone: (208)297-5806
Fax:
Email:
Susan@rhodesrebar.com;admin@RhodesRebar.com
Contractor # 03816
Website:

Business Description: Estimating, Detailing, and sales of concrete and masonry reinforcing. All work performed to date is services for Estimating & Detailing concrete reinforcing products and accessories. The values stated are for labor only, and includes CAD detailing of reinforcing. The business plan involves the purchase and resale of Estimated and Detailed items in addition to the services previously stated.

Work Code	Description
423320	Brick, Stone, and Related Construction Material Merchant Wholesalers
237310	Bridge Construction
541910	Marketing Research and Public Opinion Polling
238140	Masonry Contractors
423390	Other Construction Material Merchant Wholesalers
238110	Poured Concrete Foundation and Structure Contractors
238120	Structural Steel and Precast Concrete Contractors

Roadway Material Supply LLC	Sherry Love	Non-Minority Woman Owned/Non-Minority Women
2285 Anamanda Close Norcross, GA 30091 Physical: PO BOX 416	Phone: (770)847-7009 Fax: Email: sherry.love@roadwaymaterials.com	Contractor # 03723 Website:

Business Description: Supplier of construction, repair and maintenance materials for highways, streets and bridges.

Work Code	Description
425120	Wholesale Trade Agents and Brokers

Rocky Mountain Sand & Gravel, LLC	Crystyn Lasley	Non-Minority Woman Owned/Non-Minority Women
PO Box 22417 Cheyenne, WY 82003 Physical: 3423 Christensen Rd	Phone: (307)203-9809 Fax: 3075294123;www.rmsand(gra)vel-.com Email: rockymountainsand@gmail.com	Contractor # 03653 Website: rmsg307.com

Business Description: Supplier of aggregate material (sand and gravel); gravel roadway construction and repair; underground utility construction and repair. www.rmsandgravel.com

Work Code	Description
212321	Construction Sand & Gravel Mining
238910	Site Preparation Contractors
237110	Water and Sewer Line and Related Structures Construction

ROLLING BLUE LOGISTICS LLC	Brooke Cardwell	Non-Minority Woman Owned/Non-Minority Women
505 AGASSIZ HERMAN, MN 56248	Phone: (218)770-9342 Fax: BROOKE@ROLLINGBLUELOGIST(ICS)LLC-.COM Email: BROOKE@ROLLINGBLUELOGISTICSLLC.COM	Contractor # 03851 Website: www.rollingbluelogisticsllc.com

Business Description: MANAGEMENT OF TRANSPORTATION COMPANIES INCLUDING BOOKKEEPING, TAX PREPARATION AND ADVISORY, FINANCIAL SERVICES, LOGISTICS MANAGEMENT, FREIGHT BROKERING, PETROLEUM & PETROLEUM PRODUCTS AND BUSINESS MANAGEMENT TAILORED SPECIFICALLY TO TRANSPORTATION COMPANIES.

Work Code	Description
488510	Freight Transportation Arrangement
561110	Office Administrative Services
541219	Other Accounting Services
424720	Petroleum and Petroleum Products Merchant Wholesalers (except bulk stations and terminals)
541614	Process, Physical Distribution, and Logistics Consulting Services
541213	Tax Preparation Services

S & L Industrial	David Rael	Minority Male Owned/Hispanic
PO Box 126 Cowley, WY 82420 Physical: 675 Road 7-1/2	Phone: (307)548-2242 Fax: (307)548-2678 Email: jennie@wysli.com;casey@wysli.com;barb@wysli.com	Contractor # 00300 Website:

Business Description: Highway, Street and Bridge Construction, Guardrail, Permanent Signing, Striping, Water and Sewer Line and Related Structures Construction. ********* Removal of NAICS codes: 561990 - Flagging, 561730 - Landscaping, 238990- Fencing, & 238320- Painting **3/24/2025**

Work Code	Description
237310	Guardrail Construction
237310	Highway, Street, and Bridge Construction
237310	Painting Lines on Highways, Streets and Bridges
237310	Sign Erection, Highway, Roads Street or Bridge
237110	Water and Sewer Line and Related Structures Construction

Skyview Excavating and Grading, Inc.	Ann Wardell	Non-Minority Woman Owned/Non-Minority Women
P.O. Box 726 Morgan, UT 84050 Physical: 446 East Young St.	Phone: (801)829-6524 Fax: (801)829-6550 Email: annw@skyviewexcavation.com	Contractor # 01613 Website: www.wedigbig.com

Business Description: Excavating; earthwork; structure excavating and backfill; specialty trailers; truck haul and aggregate supply.

Work Code	Description
212321	Construction Sand & Gravel Mining

238910	Excavation Contractors
238910	Grading Construction Sites
484220	Specialized Freight (except used goods) Trucking, Local

Straight Stripe Painting, Inc.	Karen Cheever	Non-Minority Woman Owned/Non-Minority Women
1812 W. Sunset Blvd. #1-525 St. George, UT 84770 Physical: 269 N. 3500 E.	Phone: (435)656-0930 Fax: 4356270580;www.straight(str)ipe-.com Email: ar@straightstripe.com	Contractor # 03093 Website:

Business Description: Pavement striping, sign install, grooving, crash cushion, guardrail, traffic control, grinding, street sweeping. www.straightstripe.com

Work Code	Description
237310	Asphalt Paving (i.e., highway, road, street, public sidewalk)
561990	Flagging (i.e., traffic control) Services
237310	Guardrail Construction
237310	Painting Lines on Highways, Streets and Bridges
237310	Sign Erection, Highway, Roads Street or Bridge

Sub Con Manufacturing Corp.	Judi Walneck	Non-Minority Woman Owned/Non-Minority Women
930 Pyott Rd Crystal Lake, IN 60014	Phone: (847)658-6525 Fax: (847)658-1981 Email: Judi.walneck@subconmfg.com	Contractor # 03870 Website:

Business Description:

Work Code	Description
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing
334419	Other Electronic Component Manufacturing
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing

Surface Prep and Maintenance	Ann Church	Non-Minority Woman Owned/Non-Minority Women
4430 Bennie Lane Reno, NV 89512	Phone: (775)823-7882 Fax: (775)358-7362 Email: surfacepandm@gmail.com	Contractor # 03616 Website: www.surfaceprepwest.com

Business Description: Asphalt sealing, line striping and crack sealing.

Work Code	Description
238990	All Other Specialty Trade Contractors
237310	Asphalt Paving (i.e., highway, road, street, public sidewalk)
423320	Brick, Stone, and Related Construction Material Merchant Wholesalers
484110	General Freight Trucking, Local
237310	Runway, Airport, Line Painting (e.g. Striping)
484220	Specialized Freight (except used goods) Trucking, Local

Traffic Services Company, LLC	JD Wetsit	Minority Male Owned/Native American
11740 JB Road Black Hawk, SD 57718	Phone: (605)716-0250 Fax: (605)716-0260 Email: TSC@TrafficServicesCompany.com	Contractor # 03677 Website:

Business Description: Traffic control, pavement markings and permanent signing.

Work Code	Description
561990	Flagging (i.e., traffic control) Services
237310	Painting Lines on Highways, Streets and Bridges
237310	Sign Erection, Highway, Roads Street or Bridge

Venture Services LLC	Taylor Kofoed	Non-Minority Woman Owned/Non-Minority Women
423 Center Street Evanston, WY 82930	Phone: (307)660-3621 Fax: Email: taylorkofoed@icloud.com	Contractor # 03874 Website:

Business Description: Civil engineering services specializing in municipal, irrigation, aviation, transportation, and land development. The firm can perform design/bidding services and construction management

Work Code	Description
541330	Engineering Services

Willamette Technical Fabricators	Alicia Chapman	Minority Woman Owned/Black
PO Box 19383 Portland, OR 97231 Physical: 8444 NW St. Helens Rd.	Phone: (503)719-0790 Fax: javascript:newWinBlank'https(://)wtf-llc. Email: alicia.chapman@wtfllc.com	Contractor # 03852 Website: https://wtfllc.com

Business Description: Willamette Technical Fabricators produces complex lift span bridges, bascule bridges, orthotropic deck bridges, miter gates, tainter gates, bonneted lock filling valves, wicket gates, emergency wheel gates, movable spillway weirs, bulkheads, hydroelectric power dam trash-racks, and fish ladders, among other structures.

Work Code	Description
332312	Fabricated Structural Metal Manufacturing

Non-Highway DBEs

A & ASSOCIATES INC D/BA/ A&A SERVICES	ANDREW LUCHEY	Minority Male Owned/Black
951 SANSBURY'S WAY STE 203 West Palm Beach , FL 33411	Phone: (561)533-5303 Fax: (561)533-3858 Email: CERTS@AASERVICES.CO	Contractor # 03877 Website: https://aaservices.co

Business Description: TEMPORARY STAFFING/SECURITY SERVICES

Work Code	Description
561312	Executive Search Services
621610	Home Health Care Services
541612	Human Resources Consulting Services
561110	Office Administrative Services
423990	Other Miscellaneous Durable Goods Merchant Wholesalers
813319	Other Social Advocacy Organizations
561612	Security Guards and Patrol Services
561320	Temporary Help Service

A&E Caulking Solutions	Edward Collins	Minority Male Owned/Hispanic
14959 Laurel Ave. Omaha, NE 68116-3788	Phone: (402)237-7931 Fax: Email: andrew@aecaulkingsolutions.com	Contractor # 03884 Website: www.aecaulkingsolutions.com

Business Description:

Work Code	Description
238390	Other Building Finishing Contractors

Airport Vending, Inc.	Jeffery DuPont	Minority Male Owned/Native American
P.O. Box 3450 Alpine, WY 82138 Physical: 28 Larkspur Circle 4, Alpine	Phone: (307)413-4438 Fax: (307)739-8864 Email: jeffjdupont@gmail.com	Contractor # 02883 Website:

Business Description: ACDBE: Beverage and snack vending for airports and business locations.

Work Code	Description
454210	Vending Machine Operators

Atlantic Petroleum and Mineral Resources, Inc,	Anthony Ndah	Minority Male Owned/Black
1445 North Loop W Houston, TX 77008	Phone: (713)223-2767 Fax: Email: andah@atlanticpetro.com	Contractor # 03746 Website:

Business Description: Atlantic is engaged in the sale, marketing, and distribution of fuels, lubricants, chemicals and services to automotive, industrial, commercial, construction, and agricultural consumers. Provides inspection, analysis, management, collection, and solutions for hazardous waste.

Work Code	Description
541620	Environmental Consulting Services

562112	Hazardous Waste Collection
562211	Hazardous Waste Treatment and Disposal
562219	Other Nonhazardous Waste Treatment and Disposal
488490	Other Support Activities for Road Transportation
424720	Petroleum and Petroleum Products Merchant Wholesalers (except bulk stations and terminals)
56221	Waste Treatment and Disposal

Automated Enterprise, LLC | Dwight A. Armbrust Jr. | Minority Male Owned/Hispanic

1750 Remount Road, STE C #971
Charleston, SC 29406

Phone: (757)272-6487
Fax:
Email: armbrust.bus@armbrustent.com

Contractor # 03828
Website:

Business Description: Automated Enterprises offers strategic branding, business consulting, creative direction, integrated marketing, multimedia production, professional training and development services to international public and private organizations.

Work Code	Description
541611	Administrative Management and General Management Consulting Services

Avero, LLC | Abhijit Verekar | Minority Male Owned/Asian Indian

512 W. Broadway Ave.
Maryville, TN 37801

Phone: (865)415-3848
Fax:
Email: jkilgore@averoadvisors.com

Contractor # 03837
Website: http:www.averoadvisors.com

Business Description: Avero Advisors provides end to end information technology services for IT assessments, IT Strategies, business process redesign, program management, quality assurance, project management, independent validation and verification, business analysis, professional development, process facilitation, change management, RFP development, procurement support, vendor management, system selection and implementation, telecom (Unified Communications) and managed services.

Work Code	Description
541512	Computer Systems Design Services

Big Knife Resources | Rafe Espinoza | Minority Male Owned/Native American

676 Palm Beach Road
Dickinson, ND 58601

Phone: (701)264-0619
Fax:
Email: rafe.espinoza@outlook.com

Contractor # 03876
Website: https://bigkniferesources.com

Business Description:

Work Code	Description
423390	Other Construction Material Merchant Wholesalers

Black Iron Steel, LLC dba Black Iron Rebar, LLC | Kacie Hertz | Minority Woman Owned/Black

14610 Basin Dr.
Colorado Springs, CO 80908

Phone: (626)376-5228
Fax:
Email: blackironkacie@gmail.com

Contractor # 03862
Website:

Business Description: BLACK IRON STEEL, LLC, PROVIDES MANPOWER FOR REINFORCING STEEL (REBAR) INSTALLATION FOR COMMERCIAL, INDUSTRIAL, HIGHWAY AND INFRASTRUCTURE PROJECTS IN COLORADO, ARIZONA, AND WYOMING.

Work Code	Description
238120	Structural Steel and Precast Concrete Contractors

Blu Chip Consulting, LLC | Edmund Spence | Minority Male Owned/Black

125 W. Smith St
Buchanan, MI 49107

Phone: (406)546-6168
Fax:
Email: espence@bluccs.com

Contractor # 03840
Website: www.bluccs.com

Business Description: Custom Computer Programming Services. Computer Systems Design Services. Other Computer Related Services. Administrative Management and General Management Consulting Services.

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541512	Computer Systems Design Services
541519	Other Computer Related Services

BMP Environmental Consultants, Inc. | Erin E. MacCord | Minority Woman Owned/Hispanic

3712 Concord Drive
Suffolk, VA 23435

Phone: (757)618-0956
Fax:
Email: emaccord@bmpenv.com

Contractor # 03898
Website: www.bmpenv.com

Business Description: ENVIRONMENTAL CONSULTING

Work Code	Description
541620	Environmental Consulting Services

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle	Darrell Searcy	Minority Male Owned/Black
310 Vizcaya Drive Palm Beach Gardens, FL 33418	Phone: (404)643-9747 Fax: (561)630-5885 Email: Darrell@chandlercampbelle.com	Contractor # 03882 Website: ccdglobal.org

Business Description: MANAGEMENT CONSULTING TRAINING PROJECT MANAGEMENT ADVERTISING IT SERVICES AND STAFFING MERCHANT WHOLESALER

Work Code	Description
541611	Administrative Management and General Management Consulting Services
485999	All Other Transit and Ground Passenger Transportation
811192	Car Washes
541513	Computer Facilities Management Services
541512	Computer Systems Design Services
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers
561210	Facilities Support Services
722310	Food Service Contractors
722511	Full-Service Restaurants
453220	Gift, Novelty, and Souvenir Stores
561720	Janitorial Services
722513	Limited-Service Restaurants
423310	Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers
561110	Office Administrative Services
488119	Other Airport Operations
423690	Other Electronic Parts and Equipment Merchant Wholesalers
423490	Other Professional Equipment and Supplies Merchant Wholesalers
541690	Other Scientific and Technical Consulting Services
541890	Other Services Related to Advertising
611430	Professional and Management Development Training
541820	Public Relations Agencies
561320	Temporary Help Service

Cinga Technologies, LLC	Jeron Campbell	Minority Male Owned/Black
2921 Carlisle Blvd. NE Ste. 102 Albuquerque, NM 87110	Phone: (505)506-1186 Fax: Email: jeron@cingatech.com	Contractor # 03887 Website: http://www.cingatech.com

Business Description:

Work Code	Description
423430	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers
334112	Computer Storage Device Manufacturing
334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing
334111	Electronic Computer Manufacturing
423420	Office Equipment Merchant Wholesalers

Cole's Screen Printing	Brian Cole	Minority Male Owned/Black
7125 Riverdale Rd. Memphis, TN 38125	Phone: (901)340-6807 Fax: Email: brian@colesprinting.com	Contractor # 03885 Website: http://www.colesprinting.com/

Business Description: Advertising/marketing. We are a custom printing company that produces apparel, promo items, and signage for businesses, City and County governments, and over 100+ schools.

Work Code	Description
314999	All Other Miscellaneous Textile Product Mills
323111	Commercial Gravure Printing
323113	Commercial screen printing
315250	Cut and Sew Apparel Manufacturing (except Contractors)
541850	Display Advertising

541890	Other Services Related to Advertising
313310	Textile and Fabric Finishing Mills

Construction Recruiters America Staffing, Inc.	Kamalla Barbour,	Non-Minority Woman Owned/Non-Minority Women
4371 Northlake Blvd, Unit110 Palm Beach Gardens, FL 33410	Phone: (561)914-6585 Fax: Email: kam@crastaffing.com	Contractor # 03844 Website:

Business Description: CONSTRUCTION STAFFING LABORERS SPECIALTY TRADES

Work Code	Description
561320	Temporary Help Service

Cooper Resources LLC.	Kelly Bailey	Non-Minority Woman Owned/Non-Minority Women
115 E 6th St Okmulgee, OK 74447	Phone: 918777(889)8Ex-t.02 Fax: 9187772179;http://www.cooper(res)our-cesl Email: Leann@CooperResourcesLLC.com	Contractor # 03848 Website:

Business Description: Water and Sewer Line and Related Structures Construction, Water and Sewer Line and Related Structures Construction, Power and Communication Line and Related Structures Construction, Horizontal drilling (e.g., underground cable,pipeline, sewer installation

Work Code	Description
237120	Oil and Gas Pipeline and Related Structures Construction
237990	Other Heavy and Civil Engineering Construction
237130	Power and Communication Line and Related Structures Construction
237110	Water and Sewer Line and Related Structures Construction

Diversity Food Brands LLC	Jeffery Keys	Minority Male Owned/Black
53 Stonebridge Road Montclair, NJ 07042	Phone: (917)690-6463 Fax: Email: jkeys@diversityfoodbrands.com	Contractor # 03597 Website:

Business Description: ACDBE - Food service operator and licensor, airport concessionaire. www.diversityfoodbrands.com

Work Code	Description
541611	Administrative Management and General Management Consulting Services
722513	Limited-Service Restaurants
561110	Office Administrative Services
454210	Vending Machine Operators

Doss Technical Services, LLC	Geneva Doss Smith	Minority Woman Owned/Black
1010 S. Joliet Street Ste 105 Aurora, CO 80012	Phone: (303)831-1930 Fax: Email: gdoss@dosstechnical.com	Contractor # 03624 Website:

Business Description: Project administration; document/record management; certified payroll, payroll/bookkeeping; public involvement; training. www.dosstechnical.com

Work Code	Description
561990	All Other Support Services
541910	Marketing Research and Public Opinion Polling
541211	Offices of Certified Public Accountants
611430	Professional and Management Development Training
561320	Temporary Help Service

Educators 4 Education	Anthony Singleton	Minority Male Owned/Black
527 Primos Avenue Folcroft, PA 19032	Phone: (215)792-3171 Fax: Email: info@educators4education.org;asingleton@educators4education.org	Contractor # 03628 Website:

Business Description: Skill building group sessions, seminars, training, professional development workshops and webinars for youth, parents, teachers, etc. www.educators4education.org

Work Code	Description
611710	Educational Support Services

EJO Ventures, LLC	E.J. Odom	Minority Male Owned/Black
612 Hangar Lane Nashville, TN 37217	Phone: (615)437-2173 Fax: www.ejove(ntu)res-.com Email: kendall@ejoventures.net	Contractor # 03838 Website:

Business Description:

Work Code	Description
517810	All Other Telecommunications
541512	Computer Systems Design Services
238210	Electrical Contractors and Other Wiring Installation Contractors
722310	Food Service Contractors
722513	Limited-Service Restaurants
451212	News Dealers and Newsstands
517410	Satellite Telecommunications
561621	Security Systems Services (except Locksmiths)
517110	Wired Telecommunications Carriers

Entitlement & Engineering Solutions, Inc.	Amanda O'Connor	Non-Minority Woman Owned/Non-Minority Women
3801 E. Florida Ave. Ste. 425 Denver, CO 80210	Phone: (303)572-7997 Fax: (303)805-2043 Email: amanda.oconnor@ees.us.com	Contractor # 03602 Website:

Business Description: Civil engineering design, entitlement assistance, engineering consulting. www.ees.us.com

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541990	All Other Professional, Scientific, and Technical Services
541330	Civil Engineering Services

ESP Enterprises, Inc.	Steve Phelan	Minority Male Owned/Hispanic
13161 Misty Willow Drive Houston, TX 77070	Phone: (281)444-2377 Fax: (888)686-7694 Email: richard@espenterprisesinc.com	Contractor # 03553 Website: https://espenterprisesinc.com/

Business Description: Project management and planning, installation design and planning, light construction, consulting services, contract staffing, and consulting services. www.espenterprisesinc.com

Work Code	Description
561320	Temporary Help Service

Ethel G. Rubio, Assoc. AIA	Ethel Rubio	Minority Woman Owned/Asian Pacific
351 S FULLER AVE APT 1G Los Angeles, CA 90036-2946	Phone: (818)640-2946 Fax: Email: EthelRubio27@gmail.com	Contractor # 03860 Website:

Business Description: Ethel G. Rubio, Assoc. AIA, is a consulting firm specializing in project and construction management; strategic outreach and engagement; and sustainability training since 2017. Ms. Rubio is a credentialed ENVISION Sustainability Professional through the Institute for Sustainable Infrastructure (ISI), and a certified Trainer delivering sustainability credentialing workshop to professionals in the AEC sector.consulting firm specializing in project and construction management; strategic outreach and engagement; and sustainability training since 2017. Ms. Rubio is a credentialed ENVISION Sustainability Professional through the Institute for Sustainable Infrastructure (ISI), and a certified Trainer delivering sustainability credentialing workshop to professionals in the AEC sector.

Work Code	Description
541611	Administrative Management and General Management Consulting Services
561110	Office Administrative Services
611430	Professional and Management Development Training
541820	Public Relations Agencies

FDT Water Infrastructure LLC	Kayla Tanner	Minority Male Owned/Native American
1501 W. Fountainhead Parkway, Suite 550 Tempe, AZ 85282	Phone: (432)671-7575 Fax: Email: Gretl.Pineda@asrcindustrial.com	Contractor # 03890 Website:

Business Description:

Work Code	Description
238320	Painting and Wall Covering Contractors
237110	Water and Sewer Line and Related Structures Construction

Full Moon Enterprises, LLC	Lucille Mooney	Non-Minority Woman Owned/Non-Minority Women
2323 Minnesota Avenue Billings, MT 59101	Phone: (406)206-4808 Fax: (406)206-4701 Email: lm@fullmoonmt.com	Contractor # 03520 Website: www.fullmoonmt.com

Business Description: Specialty trades, shotcrete applications, shotcrete concrete machines, pumps and accessories. www.fullmoonmt.com

Work Code	Description
423810	Construction and Mining (except Oil Well) Machinery and Equipment Merchant Wholesalers
238110	Poured Concrete Foundation and Structure Contractors

Geocal, Inc.	Nur Hossain	Minority Male Owned/Hispanic
7290 South Fraser Street Centennial, CO 80112	Phone: (303)337-0338 Fax: (303)337-0347 Email: kathyglaze@geocal.us	Contractor # 02860 Website:

Business Description: Professional engineering services, including environmental impact services, geotechnical services, quality control testing and services, and FAA pavement condition indexing (PCI). www.geocal.us

Work Code	Description
541330	Engineering Services

GIL BERRY AND ASSOCIATES	Gil Berry	Minority Male Owned/Black
200 Center Street McKeesport, PA 15132	Phone: (412)720-1448 Fax: http://WWW.GILLBERRYASSO(CIA)TES-.COM Email: GILBERRY60@YMAIL.COM	Contractor # 03850 Website:

Business Description: Program management, construction consultant, real estate developer, general contractor, diversity coordinator, distributor and installer of green roofing products and vegetation, general roof maintenance and training for roof maintenance, environmental consulting services and energy consulting services, testing and analysis services for roofs, roofing contractors, and provider of roofing materials

Work Code	Description
541611	Administrative Management and General Management Consulting Services
611699	All Other Miscellaneous Schools and Instruction
423320	Brick, Stone, and Related Construction Material Merchant Wholesalers
423430	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers
238310	Drywall and Insulation Contractors
541620	Environmental Consulting Services
423310	Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers
531390	Other Activities Related to Real Estate
444190	Other Building Material Dealers
541690	Other Scientific and Technical Consulting Services
541614	Process, Physical Distribution, and Logistics Consulting Services
238160	Roofing contractors
423330	Roofing, Siding, and Insulation Material Merchant Wholesalers
541370	Surveying and Mapping (except geophysical) Services

Guytec Steel Inc.	Casel Sattar	Minority Male Owned/Asian Indian
1106 Wyckoff Avenue Ridgewood, NY 11385	Phone: (718)821-3500 Fax: 7188213700;http://www.guyte(cst)eel-.com Email: bob@guytecsteel.com	Contractor # 03846 Website:

Business Description: Supply fabrication Install structural steel Install miscellaneous Steel.

Work Code	Description
238390	Concrete coating, glazing or sealing
332312	Fabricated Structural Metal Manufacturing
541611	Strategic Planning Consulting Services
238120	Structural Steel and Precast Concrete Contractors

Heart Totes LLC	Christine Symonds	Non-Minority Woman Owned/Non-Minority Women

4140 Sandy Creek Lane Jackson, WY 83002	Phone: (307)690-2560 Fax: Email: hello@heart-totes.com	Contractor # Website:

Business Description: Sells wholesale and OTC customizable tote bags with I heart designs.

Work Code	Description
455219	All Other General Merchandise Retailers
458110	Clothing and Clothing Accessories Retailers
445131	Convenience Retailers
458320	Luggage and Leather Goods Retailers

HR Consultants, Inc.	Jonna Contaco-Sawyer	Non-Minority Woman Owned/Non-Minority Women
160 Jari Drive Suite 180 Johnstown, PA 15904	Phone: (814)266-3818 Fax: (814)266-0189 Email: brooke@hrconsults.com	Contractor # 03727 Website: www.hrconsults.com

Business Description: Human resources consulting services including benefits and compensation; employee assessment; personnel management. Administrative management and general management consulting services including strategic planning. Other Accounting Services including payroll services, human resource technical assistance. Professional and management development training including short duration courses and seminars. Education support services including education testing evaluation. www.hrconsults.com

Work Code	Description
541611	Administrative Management and General Management Consulting Services
611710	Educational Support Services
541612	Human Resources Consulting Services
541219	Other Accounting Services
611430	Professional and Management Development Training

Hudspeth and Associates Inc	Gretl Pineda	Minority Woman Owned/Native American
1501 W Fountainhead Parkway Suite 550 Tempe, AZ 58282	Phone: (303)791-5562 Fax: (303)791-5780 Email: gretl.pineda@asrcindustrial.com	Contractor # 03196 Website: www.hudspethinc.com

Business Description:

Work Code	Description
332420	Metal Tank (Heavy Gauge) Manufacturing
237990	Other Heavy and Civil Engineering Construction
562910	Remediation Services
236118	Residential Remodelers
238910	Site Preparation Contractors
237110	Water and Sewer Line and Related Structures Construction

Invision Smart Window, LLC	Dunrick Yetts	Minority Male Owned/Black
1701 W Lincoln St Broken Arrow, OK 74012	Phone: (419)823-9074 Fax: Email: dyetts32@gmail.com	Contractor # 03833 Website:

Business Description: ISW supplies hollow doors, glass/glazing and aluminum framing for windows. We also provide our patented Adjustable Glass Color (AGC) Smart Windows for all buildings and all vehicles (land, air and marine applications). In addition, AGC Smart Window can be used in greenhouse and solar panel applications.

Work Code	Description
327211	Flat Glass Manufacturing
238150	Glass and Glazing Contractors
327215	Glass Product Manufacturing Made of Purchased Glass

JKH Consulting	Joni Harlan	Non-Minority Woman Owned/Non-Minority Women
873 Barnum Road Kaycee, WY 82639	Phone: (307)738-2445 Fax: (307)738-2445 Email: jkh@rtconnect.net	Contractor # 02400 Website:

Business Description: Consultant for FTA programs, including Public Transit Programs

Work Code	Description
541690	Other Scientific and Technical Consulting Services

JMAC GROUP LLC, DBA CRAFT SAFETY INSPECTIONS & Craft Safety Industries	ReTasselyn Craft	Minority Woman Owned/Black
8406 Mosley Rd Suite A Houston, TX 77075	Phone: (832)864-2396 Fax: 8(328)642-753; Email: retasselyncraft@craftsafetyinspection.com	Contractor # 03841 Website:

Business Description: Health, Safety & Environmental Services Consultant and Training, Loss Control Consultants; Flagging and Safety Supplies, Professional Training & Development

Work Code	Description
524291	Claims Adjusting
541620	Environmental Consulting Services
561990	Flagging (i.e., traffic control) Services
541690	Other Scientific and Technical Consulting Services
611430	Professional and Management Development Training

Keleusmatic Technologies	Michael Yu	Minority Male Owned/Asian Pacific
Suite 131 Pembroke Pines, FL 33024 Physical: 8362 Pines Boulevard	Phone: (954)543-5701 Fax: Email: Michael.Yu@keleusmatic.com	Contractor # Website:

Business Description: Information Technology, Telecom and Business Systems, Design, Build and Integration Consultancy

Work Code	Description
541512	Computer Systems Design Services
238210	Electrical Contractors and Other Wiring Installation Contractors
541618	Other Management Consulting Services

Kirschner Contractors	Kim Kirschner	Non-Minority Woman Owned/Non-Minority Women
330 Uluniu Street Suite 203 Kailua, HI 96735-2541	Phone: (808)600-4013 Fax: javascript:newWinBlank'http:(//w)ww.-kirs Email: erin@kirschnercontractors.com;admin@kirschnercontractors.com	Contractor # Website:

Business Description: Construction management firm specializing in CPM scheduling and time impact analysis, cost estimating, project controls, claims, and dispute resolution.

Work Code	Description
541990	Construction estimation services
237310	Construction Management, Highway, Road, Street and Bridge
236210	Construction management, industrial building (except warehouses
237990	Construction management, mass transit
237110	Construction management, water and sewage treatment plant
237110	Construction management, water and sewer line

Kramer Associates Inc.	Lois Kramer	Non-Minority Woman Owned/Non-Minority Women
580 Utica Avenue Boulder, CO 80304	Phone: (303)247-1762 Fax: (303)909-0195 Email: lois@krameraerotek.com	Contractor # 03480 Website:

Business Description: Planning consultant, aviation consulting. www.krameraerotek.com

Work Code	Description
541613	Marketing Consulting Services
541690	Other Scientific and Technical Consulting Services
541614	Transportation Management Consulting Services

La Vie Home, Inc. dba La Vie Development, Inc.	Tonya Lewter	Minority Woman Owned/Black
1840 Wisteria Circle Bellport, NY 11713	Phone: (631)655-3280 Fax: Email: tlewter@laviedevelopment.com	Contractor # 03834 Website:

Business Description: La Vie Home, Inc. dba La Vie Development, Inc. is a Certified MWBE/ACDBE/DBE/WOSB & WBENC, HUD Section 3 Business Development Firm. The company was incorporated on June 9, 2006. Our core competency is Electric Vehicle Charging Stations' Equipment, Installation and Maintenance Services.

Work Code	Description
561110	Business Management Services

488190	Other Support Activities for Air Transportation
541720	Research and Development in the Social Sciences and Humanities

Lead at Any Level, LLC	Amy C. Waninger	Non-Minority Woman Owned/Non-Minority Women
13009 Fairfax Ct Mccordsville, IN 46055	Phone: (317)989-9600 Fax: (413)451-3767 Email: amy@leadatanylevel.com	Contractor # 03864 Website:

Business Description: Lead at Any Level, LLC specializes in inclusive leadership assessments, advisory services, and leadership development programs. We are confident that our expertise and experience will allow us to make valuable contributions to DBE and ACDBE projects in your jurisdiction.

Work Code	Description
541611	Administrative Management and General Management Consulting Services
323117	Books Printing
711510	Independent Artists, Writers, and Performers
541618	Other Management Consulting Services
611430	Professional and Management Development Training

Lenzie Henderson, LLC	Lenzie Henderson	Non-Minority Woman Owned/Non-Minority Women
15110 Kestrelglen Way Lithia, FL 33606	Phone: (985)817-0586 Fax: Email: lenzie.henderson@me.com	Contractor # 3804 Website:

Business Description: A Female owned consulting and training company. Providing one on counter sales training services in the rental car industry. Sales and compliance training in a one to one ratio or classroom training. Working with clients nationwide to training and maintain knowledgeable staff. On location airport training is key to a successful counter where business continues to grow and customers leave happy.

Work Code	Description
611430	Professional and Management Development Training

Leslie Saunders Insurance Agency, Inc.	Quincy Branch	Minority Male Owned/Black
4584 North Rancho Drive Las Vegas, NV 89130	Phone: (702)646-2082 Fax: Email: qbranch@lesliesaunders.com	Contractor # 03423 Website:

Business Description: ACDBE: Insurance agency and professional development training for airport rental car agencies. www.lesliesaunders.com

Work Code	Description
524298	All Other Insurance Related Activities
541612	Human Resources Consulting Services
524210	Insurance Agencies and Brokerages
541613	Marketing Consulting Services
488190	Other Support Activities for Air Transportation
611430	Professional and Management Development Training

Linear A, LLC	Erik Carlson	Minority Male Owned/Hispanic
412 SORBONNE RUE YUTAN, NE 68073-1000	Phone: (402)216-5288 Fax: Email: erik@lineara.io	Contractor # 03854 Website: https://lineara.io/linear-a/home/our-team/

Business Description: We are a data-focused and information-driven strategic consultancy. Our experience across multiple verticals - healthcare, architecture, finance, and technology - enables us to realize the power of an integrated, data-informed process on highly complex projects and within organizations. We help you leverage the power of data by balancing the art of strategic consulting with the science of analysis

Work Code	Description
541611	Administrative Management and General Management Consulting Services
561499	All Other Business Support Services
541620	Environmental Consulting Services
541618	Other Management Consulting Services
541690	Other Scientific and Technical Consulting Services

Longhouse Inventory Solutions, Inc.	Jami Jones	Minority Woman Owned/Native American
P.O. Box 1212 Claremore, OK 74017 Physical: 21052 S. 4175 Rd	Phone: (918)342-3127 Fax: (918)342-2423 Email: jami@lisstore.com	Contractor # 03518 Website: www.lisstore.com

Business Description: ACDBE: Supplier of child safety seats, car seat storage bags, security loops, dapple cleaner, locking clips, specialty sign bases and trolly frames. Manufacturer of security key drops. www.lisstore.com

Work Code	Description
423390	Other Construction Material Merchant Wholesalers
332439	Other Metal Container Manufacturing

Lumenor Consulting Group, Inc	Bridgette Beoto	Non-Minority Woman Owned/Non-Minority Women
11475 Great Oaks Way, Ste 240 Alpharetta, GA 30022	Phone: (404)918-9078 Fax: Email: dbe@lumenorconsulting.com	Contractor # Website:

Business Description: Five23 Group/Lumenor Consulting Group is a certified DBE/WBE/SBE consulting firm focused on delivery of quality business and technology solutions. Since 2007, LCG has specialized in providing consulting services to the transit and government sectors. Clients successfully utilize LCG's assessment, integration, and organizational change experience to gain transparency, compliance, and make effective business decisions.

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541990	All Other Professional, Scientific, and Technical Services
541512	Computer Systems Design Services
541370	Construction Surveying Services
541620	Environmental Consulting Services
541613	Marketing Consulting Services
541910	Marketing Research and Public Opinion Polling
541519	Other Computer Related Services
541618	Other Management Consulting Services
541690	Other Scientific and Technical Consulting Services
541614	Process, Physical Distribution, and Logistics Consulting Services
611430	Professional and Management Development Training
541370	Surveying and Mapping (except geophysical) Services

M.S. Clark Enterprises, Inc., DBA Nationwide Parking Services, Inc.	Angela Clark	Minority Woman Owned/Black
1400 16th Street Suite 400 Denver, CO 80202	Phone: (800)291-8237 Fax: (888)761-8959 Email: aclark@nwprk.com	Contractor # 03879 Website: https://www.nwprk.com/

Business Description: Staffing, Transportation and Parking Management Services

Work Code	Description
485999	Airport shuttle services
812930	Parking Lots and Garages
812930	Parking services, valet

Marathon Reprographics Inc DBA MySmartPlans	Shelley Armato	Minority Woman Owned/Other Disadvantage
803 Armstrong Ave. Level B Kansas City, KS 66101	Phone: (816)221-7881 Fax: 8162415237;http://www.mysma(rtp)lan-s.co Email: dominick.armato@mysmartplans.com	Contractor # 03849 Website:

Business Description: Software as a Service for document commissioning during a construction project.

Work Code	Description
323111	Commercial Printing (except Screen and Books)
541512	Computer Systems Design Services
611420	Computer Training
541511	Custom Computer Programming Services
561410	Document Preparation Services
561439	Other Business Service Centers (including Copy Shops)

Marr Arnold Planning, LLC	Summer Marr	Non-Minority Woman Owned/Non-Minority Women
1328 California Ave. Ames, IA 50014	Phone: (515)231-0344 Fax: http://www.marrarnoldpl(ann)ing-.com Email: summer@marrarnoldplanning.com	Contractor # 03552 Website: http://marrarnoldplanning.com/

Business Description: ACDBE: Aviation planning, project management, environmental analysis, FAA compliance planning, research and support services. www.marrarnoldplanning.com

Work Code	Description

541611	Administrative Management and General Management Consulting Services
488190	Other Support Activities for Air Transportation

Martinez Geospatial, Inc.	Anthony Martinez	Minority Male Owned/Hispanic
2915 Waters Road, Suite 100 Eagan, MN 55121	Phone: (651)686-8424 Fax: (651)686-8389 Email: john@mtzgeo.com	Contractor # 02984 Website:

Business Description: Photogrammetry and aerial mapping. www.mtzgeo.com

Work Code	Description
541370	Surveying and Mapping (except geophysical) Services
561320	Temporary Help Service

Mary A. Lynch	Mary A. Lynch	Non-Minority Woman Owned/Non-Minority Women
5719 Overridge Drive Arlington, TX 76017	Phone: (817)478-3308 Fax: Email: malynch316@aol.com	Contractor # 03521 Website:

Business Description: Aviation consultant, planning, marketing feasibility services.

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541613	Marketing Consulting Services
488119	Other Airport Operations
541618	Other Management Consulting Services
488190	Other Support Activities for Air Transportation

Mary's Cleaning Service, LLC	Mary Espinoza	Non-Minority Woman Owned/Non-Minority Women
4604 Horizon Loop Cheyenne, WY 82009	Phone: (307)631-5790 Fax: (307)635-7893 Email: maryscleaning48@yahoo.com	Contractor # 03582 Website: www.maryjocleaningservice.com

Business Description: Cleaning service.

Work Code	Description
561720	Janitorial Services

Meltar Supply LLC	Tara Harmon-Kramer	Non-Minority Woman Owned/Non-Minority Women
5534 Cedar Crest Street Houston, TX 77087	Phone: (503)957-2810 Fax: Email: Tara@meltarsupply.com	Contractor # Website:

Business Description: Direct ship material supplier for all projects and construction materials. Company also rents and sells equipment needed for a variety of projects.

Work Code	Description
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers
423840	Industrial Supplies Merchant Wholesalers
444190	Other Building Material Dealers
423390	Other Construction Material Merchant Wholesalers
423330	Roofing, Siding, and Insulation Material Merchant Wholesalers
423860	Transportation Equipment and Supplies (except motor vehicle) Merchant Wholesalers
425120	Wholesale Trade Agents and Brokers

Moore Installs LLC	Clifford Moore	Minority Male Owned/Black
1958 Butler Pike Suite 506 Conshohocken,, PA 19428	Phone: (484)576-3430 Fax: Email: cmoore@mooreinstalls.com	Contractor # 03856 Website:

Business Description: Specializes in automotive electronics,installations, services, sales and consulting.

Work Code	Description
811114	Electrical repair shops, automotive

Mountain West Drivers Corp.	Lisa Stokes	Minority Woman Owned/Hispanic
P.O. Box 150251 Ogden, UT 84415 Physical: 5233 Skyline Drive	Phone: (801)388-7198 Fax: (801)475-4078 Email: mountainwestdrivers@gmail.com	Contractor # 03564 Website:

Business Description: Provide drivers for rental car companies.

Work Code	Description
488490	Other Support Activities for Road Transportation

National Essentials, LLC, DBA See's Candies, Colorado Lottery, Route 70	Kara Dar	Non-Minority Woman Owned/Non-Minority Women
274 S. Olive Street Denver, CO 80224	Phone: (303)807-0298 Fax: Email: karadar76@yahoo.com	Contractor # 03888 Website:

Business Description: Airport Concession Retail (Beauty Accessories, Skin Care and Travel Accessories)

Work Code	Description
458110	Apparel accessory stores
458110	Apparel stores, womens and girls clothing
445292	Confectionery and Nut Retailers
445292	Confectionery stores, packaged, retailing only

Natural System Analysts, Inc.	Peter K Gottfried	Minority Male Owned/Hispanic
P.O. Box 671 Dubois, WY 82513 Physical: 52 Bald Mt. Road	Phone: (407)718-3880 Fax: Email: petergottfried@gis1.com	Contractor # 03467 Website:

Business Description: Environmental and GIS consulting. www.gis1.com

Work Code	Description
541620	Environmental Consulting Services

Navjoy Consulting Services, Inc.	Navin Nageli	Minority Male Owned/Asian Pacific
7340 East Caley Avenue Suite 100W Centennial, CO 80111	Phone: (720)399-4402 Fax: Email: kgreene@navjoyinc.com	Contractor # 03177 Website:

Business Description: Transportation system consulting including traffic engineering/transportation engineering; traffic operations and transportation planning; and traffic data services. www.navjoyinc.com

Work Code	Description
541330	Civil Engineering Services
541512	Computer Systems Design Services
237310	Construction Management, Highway, Road, Street and Bridge
541618	Other Management Consulting Services
541690	Other Scientific and Technical Consulting Services
541614	Transportation Management Consulting Services

Nexus AEC, LLC DBA Titan AEC	Shobhit Baadkar	Minority Male Owned/Asian Indian
633 W. 5th Street 26th Floor Los Angeles, CA 90071	Phone: (310)651-6867 Fax: Email: sbaadkar@titanaec.com	Contractor # 03855 Website:

Business Description: Professional consulting firm providing services for building informationmodeling (BIM), virtual design & construction (VDC), LiDAR, geographicalinformation systems (GIS), project management, program management, andstaff augmentation

Work Code	Description
541513	Computer Facilities Management Services
541512	Computer Systems Design Services
611420	Computer Training
541340	Computer-Aided Design and Drafting Services
541511	Custom Computer Programming Services

NLD Engineering, Inc.	Nina Lynn Dickhausen	Non-Minority Woman Owned/Non-Minority Women

7534 S Quatar Way Aurora, CO 80016	Phone: (512)808-8251 Fax: Email: nld@nldeng.com	Contractor # 03767 Website: https://nldeng.com/

Business Description: Bridge Inspection Services. NBIS bridge inspections and associated engineering services including CAD, data entry, document review, QA/QC, and project management.

Work Code	Description
541330	Civil Engineering Services
541330	Engineering Services

OMG It's Gluten Free, LLC	Julie Scianna	Non-Minority Woman Owned/Non-Minority Women
10319 Vans Dr. Unit A Frankfort, IL 60423	Phone: (815)469-4900 Fax: Email: julie@omgitsglutenfree.com	Contractor # Website:

Business Description: Small manufacturer selling to direct and wholesale buyers across the United States. Products include pizzas, baked goods, breads, and various entrees that serve customers with a wide variety of food allergies. All of our products are 100% gluten free and nut free, and some products are dairy free, sugar free, and vegan.

Work Code	Description
311811	Bakeries with Baking from Flour on the Premises; Retailing not for Immediate Consumption
424490	Bakery Products (Except Frozen) Merchant Wholesaler; Bread Packaged (Except Frozen) Merchant Wholesaler; Health Food (Except Fresh Fruits, Vegetables) Merchant Wholesaler; Prepared Foods (Except Frozen) Merchant Wholesaler
311812	Commercial Bakeries
311821	Cookies & Cracker Manufacturing
311991	Perishable Prepared Food Manufacturing

PAJARDO ELECTRIC CO., INC.	ENRIQUE PAJARDO	Minority Male Owned/Black
5315 Barbara Avenue Baltimore, MD 21206	Phone: (410)485-9122 Fax: Email: epajardo@hotmail.com	Contractor # 03868 Website: http://WWW.PAJARDOELECTRIC.COM

Business Description: 38210 - Electrical Contractors and Other Wiring Installation Contractors (SPECIFICALLY: ELECTRICAL INSTALLATION CONTRACTORS, CONSTRUCTION AND PROJECT MANAGEMENT); 423610 - Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers; 541350 - Building inspection services

Work Code	Description
541350	Building Inspection Services
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers
238210	Electrical Contractors and Other Wiring Installation Contractors
541712	Research and Development in the Physical, Engineering, and Life Sciences (except biotechnology)

PARALEGAL CONSULTANTS, LLC	Valerie M Nowottnick	Non-Minority Woman Owned/Non-Minority Women
2080 24th Ave NE Naples, FL 34120	Phone: (239)986-4237 Fax: Email: VALERIE@PARALEGALCONSULT.COM	Contractor # 03881 Website: https://www.paralegalconsult.com/

Business Description: LITIGATION SUPPORT AND OFFICE MANAGEMENT CONSULTING SERVICES TO LICENSED ATTORNEYS AND LAW FIRMS; BUSINESS MANAGEMENT AND CONSULTING SERVICES; ADMINISTRATIVE, CLERICAL AND CONSULTATION SERVICES, GENERALLY; EVENT PLANNING

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541199	All Other Legal Services
561920	Convention and Trade Show Organizers
561110	Office Administrative Services

Paul Carpenter Associates, Inc	Sharon Paul Carpenter	Non-Minority Woman Owned/Non-Minority Women
7 Columbia Turnpike Suite 101 Florham Park, NJ 07932	Phone: (973)822-8221 Fax: Email: sharonpc@pcairnoisetraffic.com	Contractor # 03730 Website: https://www.pcairnoisetraffic.com/

Business Description: Environmental consulting services, acoustics: air quality, noise & vibration assessment, environmental and pollution testing. www.pcairnoisetraffic.com

Work Code	Description
541620	Environmental Consulting Services
541380	Testing Laboratories

Peak Environmental Management, Inc	Myra Peak	Non-Minority Woman Owned/Non-Minority Women

P.O. Box 404 Green River, WY 82935 Physical: 2200 Mississippi Ave.	Phone: (307)870-4592 Fax: (307)875-5179 Email: myrapeak@gmail.com	Contractor # 02284 Website:

Business Description: Environmental consulting and safety training including HAZWOPER and other OSHA training, soils sampling and consulting for reclamation, phase I and II environmental site assessments, wetlands delineation, and threatened and endangered species studies

Work Code	Description
541620	Environmental Consulting Services
541690	Other Scientific and Technical Consulting Services

Preferred Construction Mgt Co., Inc.	Kyla Magnusson	Non-Minority Woman Owned/Non-Minority Women
1395 Route 23 Unit 7 Butler, NJ 07405	Phone: (973)853-6060 Fax: (973)853-4645 Email: alexis@pcmcompany.com	Contractor # 03901 Website: http://www.pcmcompany.com

Business Description: Construction management; cost estimating; value engineering support; Critical Path Method (CPM) scheduling; cost analysis claims analysis; plan specifications; building feasibility reviews; and project support services.

Work Code	Description
237310	Construction Management, Highway, Road, Street and Bridge
236210	Construction management, industrial building (except warehouses
237990	Construction management, mass transit
237110	Construction management, water and sewer line
236116	New Multifamily Housing Construction (except for-sale builders)
237120	Oil and Gas Pipeline and Related Structures Construction

Probity Professional Technical Writing, L.L.C.	Cheryl L. Bean	Non-Minority Woman Owned/Non-Minority Women
1720 Silver Spur Road Cheyenne, WY 82009	Phone: (307)888-1502 Fax: Email: Cheryl.probitytw@gmail.com	Contractor # 03819 Website:

Business Description: Professional technical writing services, including grant applications, specifications, procedural documents, etc., and related services.

Work Code	Description
541611	Administrative Management and General Management Consulting Services

Project Solutions, Inc.	Sandra Burns	Non-Minority Woman Owned/Non-Minority Women
505 Kansas City Street Rapid City, SD 57701	Phone: (605)737-0377 Fax: (605)355-6961 Email: dbe@projectsolutionsinc.com	Contractor # 03883 Website: https://projectsolutionsinc.com

Business Description: Consultant - business, management, Construction inspection, specialty staffing

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541330	Engineering Services

PureSky, LLC	Justin Clayborne	Minority Male Owned/Black
525 W. Main Street, Suite 105 Belleville, IL 62220	Phone: (404)938-3342 Fax: Email: justin@pureskyllc.com	Contractor # 03836 Website:

Business Description: Credit card processing services; Financial Transactions Processing, Reserve, and Clearinghouse Activities; Administrative Management and General Management Consulting Services

Work Code	Description
541611	Administrative Management and General Management Consulting Services
522320	Credit card processing services

Rare Agricultural Products, LLP	Rashad Reed	Minority Male Owned/Black
212 Endoline Dr. Apt. B Leesburg, GA 31763	Phone: (303)505-6716 Fax: Email: SALES@RAREAGPRODUCTS.COM	Contractor # 03897 Website: https://rareagriculturalproducts.com/

Business Description: Rare Agricultural Products, LLP is a vendor and wholesaler of agricultural products, which includes, fertilizer, insecticides, fungicides, soil amendments, soil treatment products, greenhouse sanitation products, seeds and herbicides. We consult clients on nutrient Management and integrated pest management to provide them with the right products for their areas of concern. We demonstrate the efficacy of the products we sell by helping to mix, apply, spray and cultivate plants based on our recommendations.

Work Code	Description
424910	Farm Supplies Merchant Wholesalers
115112	Soil Preparation, Planting, and Cultivating

Real West Natural Resource Consulting	Amber Travsky	Non-Minority Woman Owned/Non-Minority Women
1116 Albin St. Laramie, WY 82072	Phone: (307)742-3506 Fax: (307)745-6132 Email: atravsky@wyoming.com	Contractor # 02300 Website:

Business Description: Environmental consulting including wildlife and vegetation surveying and monitoring; endangered species surveys; wetland evaluations and delineations; baseline analysis for mining permits; and habitat assessments

Work Code	Description
541620	Environmental Consulting Services
541712	Research and Development in the Physical, Engineering, and Life Sciences (except biotechnology)

River Street Group, LLC	Carol Comer	Non-Minority Woman Owned/Non-Minority Women
2 E. Bryan St, Ste 600A Savannah, GA 31401	Phone: (770)639-0331 Fax: Email: ccomer@riverstreetgroupllc.com	Contractor # Website:

Business Description: Provides transportation planning, project management and program management consulting services for federal, state and local governments. Additional services include public relations

Work Code	Description
541611	Administrative Management and General Management Consulting Services

ROCK SOLID PROJECT SOLUTIONS INC	Raquel Floyd	Non-Minority Woman Owned/Non-Minority Women
500 S. Rancho Rd, ste 7 Las Vegas, NV 89106	Phone: (702)272-2378 Fax: 7024412023;https://rockso(lid)sol-utio Email: ranzevino@rock-solid-solutions.com	Contractor # 03857 Website:

Business Description: Construction consulting company specializing in project controls (costs estimating, delays, scheduling)

Work Code	Description
541614	Process, Physical Distribution, and Logistics Consulting Services

ROLLING BLUE LOGISTICS LLC	Brooke Cardwell	Non-Minority Woman Owned/Non-Minority Women
505 AGASSIZ HERMAN, MN 56248	Phone: (218)770-9342 Fax: BROOKE@ROLLINGBLUELOGIST(ICS)LLC-.COM Email: BROOKE@ROLLINGBLUELOGISTICSLLC.COM	Contractor # 03851 Website: www.rollingbluelogisticsllc.com

Business Description: MANAGEMENT OF TRANSPORTATION COMPANIES INCLUDING BOOKKEEPING, TAX PREPARATION AND ADVISORY, FINANCIAL SERVICES, LOGISTICS MANAGEMENT, FREIGHT BROKERING, PETROLEUM & PETROLEUM PRODUCTS AND BUSINESS MANAGEMENT TAILORED SPECIFICALLY TO TRANSPORTATION COMPANIES.

Work Code	Description
488510	Freight Transportation Arrangement
561110	Office Administrative Services
541219	Other Accounting Services
424720	Petroleum and Petroleum Products Merchant Wholesalers (except bulk stations and terminals)
541614	Process, Physical Distribution, and Logistics Consulting Services
541213	Tax Preparation Services

Rooted Landscape Architecture, LLC	Pauline Chu	Minority Woman Owned/Asian Pacific
PO Box 3637 Jackson, WY 83001 Physical: 580 Saddle Butte Way	Phone: (307)203-5520 Fax: Email: pauline@rooted-la.com	Contractor # 03670 Website:

Business Description: Provides landscape architectural and planning services. www.rooted-la.com

Work Code	Description
541320	Landscape Architectural Services

SAMPATH, THAMARAI S DBA Logg	Thamarai selvi Sampath	Minority Woman Owned/Asian Indian

490 Liberty Ave Apt 1 Jersey City, NJ 07307	Phone: (201)952-0562 Fax: Email: selvi@loggcorp.com	Contractor # 03867 Website: https://loggcorp.com

Business Description: IT Staffing and consulting

Work Code	Description
561320	Contract Staffing Services
561320	Office Help Supply Services
561320	Temporary Staffing Service

SENSIS INC.	Jose Villa	Minority Male Owned/Hispanic
1651 S CENTRAL AVE STE A GLENDALE, CA 91204	Phone: 2133410(171)Ext-.708 Fax: (213)402-6372 Email: jrvilla@sensisagency.com	Contractor # 03859 Website:

Business Description: We bridge gaps, build exciting brands, and foster meaningful connections across cultures with our diverse marketing approach.

Work Code	Description
541810	Advertising Agencies
518210	Computing Infrastructure Providers, Data Processing, Web Hosting, and Related Services
541511	Custom Computer Programming Services
541830	Media Buying Agencies

Serrmi Products, LLC	Larry Seward III	Minority Male Owned/Hispanic
1210 N. Walnut Street Pittsburg, KS 66762 Physical: 1308 N Walnut Street	Phone: (620)404-4422 Fax: 6202316421;www.serrmipr(odu)cts-.com Email: info@serrmiproducts.com	Contractor # 03814 Website:

Business Description: Primary business activity is Manufacturing Railroad Enclosures and Signal Products.

Work Code	Description
332312	Fabricated Structural Metal Manufacturing
334515	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals
423690	Other Electronic Parts and Equipment Merchant Wholesalers
332618	Other Fabricated Wire Product Manufacturing
332311	Prefabricated Metal Building and Component Manufacturing
423860	Transportation Equipment and Supplies (except motor vehicle) Merchant Wholesalers

Shrewsberry & Associates, LLC	Anothony Warren	Minority Male Owned/Black
7321 Shadeland Station Ste 160 Indianapolis, IN 46256	Phone: (317)841-4799 Fax: (317)841-4790 Email: certifications@shrewsusa.com	Contractor # 03559 Website:

Business Description: Construction management, environmental consulting and engineering, inspection (bridge and construction). www.shrewusa.com

Work Code	Description
237310	Construction Management, Highway, Road, Street and Bridge
541330	Engineering Services
541620	Environmental Consulting Services
541320	Landscape Architectural Services
541910	Marketing Research and Public Opinion Polling
541618	Other Management Consulting Services
541690	Other Scientific and Technical Consulting Services
541614	Process, Physical Distribution, and Logistics Consulting Services
562910	Remediation Services
221310	Water Supply and Irrigation Systems

Southern Partners, Inc.	Nicole Sias	Minority Male Owned/Black
638 Camino De Los Mares Ste. H150-450 San Clemente, CA 92673 Physical: 999 Corporate Dr. Ste 100	Phone: (714)501-2778 Fax: Email: msias@southern-partners.com	Contractor # 03756 Website:

Business Description: Marketer of power, crude oil and natural gas as well as other petroleum products and renewables.

Work Code	Description
541690	Other Scientific and Technical Consulting Services
424720	Petroleum and Petroleum Products Merchant Wholesalers (except bulk stations and terminals)
425120	Wholesale Trade Agents and Brokers

SRL Enterprises LLC	Romaine Lewis	Minority Male Owned/Black
111 Town Square Place Suite 1203 Jersey City, NJ 073310	Phone: (877)726-0272 Fax: 2016087890;https://www.srlente(rpr)ise-s.co Email: rolewis@srlenterprises.com	Contractor # 03853 Website:

Business Description: Consultants: Contract Compliance Integrity Monitorng Oversight and Reporting DBE, MBE, MWBE, and SBE program development Certification and management community outreach and marketing services

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541990	All Other Professional, Scientific, and Technical Services
541720	Business research and development services
541612	Human Resources Consulting Services
541613	Marketing Consulting Services
541618	Other Management Consulting Services

STEVE POLICAR LLC	Steven Policar	Minority Male Owned/Hispanic
25906 SE 39TH Place Issaquah, WA 98029	Phone: (425)829-2154 Fax: Email: spolicar@comcast.net	Contractor # Website:

Business Description: STEVE POLICAR LLC is an independent procurement consultant and Buy America Auditor for public mass transit, with special emphasis on Federal Transit Administration (FTA) and Federal Railroad Administration (FRA) Buy America compliance, providing Buy America Pre-Award and Post-Delivery Audit services, and Buy America compliance assessments.

Work Code	Description
541611	Administrative Management and General Management Consulting Services

Sub Con Manufacturing Corp.	Judi Walneck	Non-Minority Woman Owned/Non-Minority Women
930 Pyott Rd Crystal Lake, IN 60014	Phone: (847)658-6525 Fax: (847)658-1981 Email: Judi.walneck@subconmfg.com	Contractor # 03870 Website:

Business Description:

Work Code	Description
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing
334419	Other Electronic Component Manufacturing
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing

Synergy Systems & Services, Inc.	Abhay Nigam	Minority Woman Owned/Other Disadvantage
11155 Dolfield Rd #114 Owings Mills, MD 21117	Phone: (410)413-1872 Fax: Email: Laci@sss-inc.com	Contractor # Website:

Business Description: Onsite business consulting, including database management, traffic and GIS applications, etc.

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541513	Computer Facilities Management Services
541512	Computer Systems Design Services
541511	Custom Computer Programming Services
541910	Marketing Research and Public Opinion Polling
541370	Surveying and Mapping (except geophysical) Services
561320	Temporary Help Service

Terranext, LLC	Kim Martin	Non-Minority Woman Owned/Non-Minority Women

1660 South Albion, Suite 344 Denver, CO 80222	Phone: (303)399-6145 Fax: (303)399-6146 Email: kmartin@terranext.net	Contractor # 03048 Website:

Business Description: Environmental remediation. www.terranext.net

Work Code	Description
541620	Environmental Consulting Services

The Art of Concrete, LLC	Karen Keyes	Non-Minority Woman Owned/Non-Minority Women
7845 E. Harvard Avenue Denver, CO 80231	Phone: (720)534-5001 Fax: (720)255-2053 Email: karen@theartofconcretellc.com	Contractor # 03714 Website: https://www.theartofconcretellc.com/

Business Description: Installs decorative concrete for commercial application - both interior and exterior use.

Work Code	Description
238990	All Other Specialty Trade Contractors
237310	Concrete Paving (i.e., highway, road, street, public sidewalk)
238390	Other Building Finishing Contractors
238110	Poured Concrete Foundation and Structure Contractors

The Aviation Planning Group, LLC	Leah Whitfield	Non-Minority Woman Owned/Non-Minority Women
7694 W Quarto Ave. Littleton, CO 80128 LaMont, IL 60439 Physical: 6 Division Ct	Phone: (720)441-4623 Fax: Email: leah@theaviationplanninggroup.com	Contractor # 03768 Website:

Business Description: Partner with airports and aviation businesses to: plan for their future; sustain compliance; accommodate demand; and design and provide construction management for the maintenance/replacement of infrastructure using private, local, state and federal funds.

Work Code	Description
541611	Administrative Management and General Management Consulting Services
561990	All Other Support Services
541620	Environmental Consulting Services
541910	Marketing Research and Public Opinion Polling
541618	Other Management Consulting Services
541611	Strategic Planning Consulting Services

The Quotient Group	Kimberly Sippola	Non-Minority Woman Owned/Non-Minority Women
N1374 Tuckaway Ct Greenville, WI 54942	Phone: (920)809-4550 Fax: Email: kim@thequotientgroup.com	Contractor # 03690 Website:

Business Description: ACDBE. Full service aviation and transit marketing agency specializing in strategic development, market research, branding, marketing support, promotions, internal & crisis communication, website design and graphic design. www.thequotientgroup.com

Work Code	Description
541810	Advertising Agencies
541613	Marketing Consulting Services
541910	Marketing Research and Public Opinion Polling
541820	Public Relations Agencies

THE W GROUP CONSULTING FIRM, LLC	WENDY ANDERSON	Minority Woman Owned/Black
8815 CONROY WINDERMERE ROAD SUITE 212 Orlando, FL 32835	Phone: (407)502-3175 Fax: (407)320-7224 Email: WENDY@THEWGCFIRM.COM	Contractor # 03873 Website:

Business Description: RETAIL, FOOD AND BEVERAGE AND BUSINESS MANAGEMENT AND CONSULTING SERVICES

Work Code	Description
541611	Administrative Management and General Management Consulting Services
455219	All Other General Merchandise Retailers
459210	Book Retailers and News Dealers
445131	Convenience Retailers
722511	Full-Service Restaurants
453220	Gift, Novelty, and Souvenir Stores

541613	Marketing Consulting Services
541820	Public Relations Agencies

Trails West Architecture, LLC	Megan Hayward	Non-Minority Woman Owned/Non-Minority Women
	Phone: (402)707-9451	Contractor # 03742
Morill, NE 69358	Fax:	Website:
Physical: 100794 CRD	Email: megan@trailswarch.com	

Business Description: Architectural firm that can do preliminary planning, schematic design, design development, construction documents, construction administration, rendering services.

Work Code	Description
541310	Architectural Services

Transportation Management & Design, Inc.	China Langer	Non-Minority Woman Owned/Non-Minority Women
2701 Loker Ave West Suite 110	Phone: 7604769(600)Ext-.107	Contractor # 03872
Carlsbad, CA 92010	Fax: (877)532-5594	Website: https://tmdinc.net/
	Email: accounting@tmdinc.net	

Business Description: TMD provides consulting services for design of integrated network transit corridor planning; analysis of bus and rail corridor public ridership; assessment of agency operational performance for improvement of staff utilization, supervision, training, policies, and procedures; optimization cost development of transit trip schedules, fleet vehicles and operators deployment, fare policy analysis, financial planning models for cost effective transportation facilities related to bus stops, shelters, multimodal stations and central hubs; development of alternative mobility transportation designs related to micro-transit systems; Title VI equity market analysis for agency stakeholders and public engagement.

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541614	Process, Physical Distribution, and Logistics Consulting Services
541320	Urban planning services

TrendTech Logistics LLC	Reginald Smith	Minority Male Owned/Black
2959 Chapel Hill Road #1259	Phone: (260)579-8742	Contractor # 3894
Douglasville, GA 30135	Fax: (770)947-0856	Website: https://www.trendtechlogistics.com/
	Email: reginald.smith@trendtechlogistics.com	

Business Description: Freight transportation and administrative management

Work Code	Description
541611	Administrative Management and General Management Consulting Services
561499	All Other Business Support Services
488510	Freight Transportation Arrangement
561110	Office Administrative Services
541618	Other Management Consulting Services

TYLER COMMUNICATIONS INC.	Tony Tyler	Minority Male Owned/Black
950 West Peachtree St. Suite 220	Phone: (404)923-0038	Contractor # 03470
Atlanta, GA 30309	Fax: (404)928-0038	Website:
	Email: info@tylercommunications.net	

Business Description: Business development consultant. www.tylercommunications.net

Work Code	Description
561990	All Other Support Services
611710	Educational Support Services
561110	Office Administrative Services
611430	Professional and Management Development Training

Unison Consulting, Inc.	Yovette Drake	Minority Woman Owned/Black
150 N Michigan Ave., Ste. 2930	Phone: (312)988-3360	Contractor # 03875
Chicago, IL 60601	Fax: (312)988-3370	Website: https://unison-ucg.com/
	Email: yovettedrake@unison-ucg.com	

Business Description:

Work Code	Description
541611	Administrative Management and General Management Consulting Services
541720	Business research and development services

541512	Computer Systems Design Services
611420	Computer Training
531312	Nonresidential Property Managers
541519	Other Computer Related Services
541690	Other Scientific and Technical Consulting Services
513210	Software Publishers

US ATM Network, Inc, dba US Payment Network | Kimberly McKiinley | Minority Woman Owned/Hispanic

P.O. Box 259
Balsalt, CO 81621
Physical: 1229 Green Meadow Road

Phone: (970)379-4559
Fax:
Email: kmckinley@usatmnet.com

Contractor # 03827
Website: https://www.usatmnet.com/

Business Description: US ATM Network, Inc. is a full service independent ATM deployer. We provide end-to-end ATM and cash management services for airports, municipalities, banks, hotels, convenience stores, grocery stores, restaurants, retail stores, and more. We own and operate ATM terminals in 20 states and we are in partnership with federally chartered banks including US Bank, Zions Bank, Pueblo Bank & Trust, Meta Bank, Wilmington Federal Savings, Alpine Bank, Bank of Albuquerque and other local financial institutions. US ATM Network, Inc. operates in partnership with nationwide carrier management and ATM service and repair companies to coordinate cash logistics, replenishment, service and repairs. Our partners are among the largest carriers and service companies which include Loomis, Burroughs, Guarda, Sectran.

Work Code	Description
238290	ATMs (automated teller machines) installation
522320	Automated Teller Machine (ATM) or Automated Loan Machine (ALM) network operation
522320	Credit card processing services
522320	Electronic financial payment services
522320	Financial transactions processing (except central bank)

Valley Illuminators | Polly Valley | Non-Minority Woman Owned/Non-Minority Women

P.O. Box 64095
Tacoma, WA 98465
Physical: 1003 S. Pearl Street #B11

Phone: (253)565-6946
Fax:
Email: pollyv@zipcon.com

Contractor # 02406
Website:

Business Description: Manufacture of airport illuminators for runways, taxiways, thresholds, obstructions, rampages and for all other roadway markings. www.valleyilluminators.com

Work Code	Description
335129	Other Lighting Equipment Manufacturing
423990	Other Miscellaneous Durable Goods Merchant Wholesalers

Venture Services LLC | Taylor Kofoed | Non-Minority Woman Owned/Non-Minority Women

423 Center Street
Evanston, WY 82930

Phone: (307)660-3621
Fax:
Email: taylorkofoed@icloud.com

Contractor # 03874
Website:

Business Description: Civil engineering services specializing in municipal, irrigation, aviation, transportation, and land development. The firm can perform design/bidding services and construction management

Work Code	Description
541330	Engineering Services

WIDEFIELD TECHNOLOGY, INC. | Amanda NM Davis | Minority Woman Owned/Hispanic

6501 Pinecone Ln
Pinetop, AZ 85935

Phone: (480)993-2204
Fax: (480)626-8503
Email: amanda@wti1.net

Contractor # 03807
Website:

Business Description: Energy Consulting, Global Source Consulting and Broker of LED Lighting

Work Code	Description
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers
541618	Other Management Consulting Services
541690	Other Scientific and Technical Consulting Services
425120	Wholesale Trade Agents and Brokers

WING BOYS DELI INC | AngelicaTorres | Minority Woman Owned/Hispanic

8013 Citrus park town center
Tampa, FL 33625

Phone: (813)546-4927
Fax: (813)237-4654
Email:
INFO@WINGBOYS100.COM;wingboyz100@gmail.com

Contractor # 03858
Website: www.wingboys100.com/

Business Description: LIMITED-SERVICE RESTAURANT SERVING OVER 100 FLAVORS OF WINGS, QUESADILLAS, WRAPS, FRIES, CHICKEN BOWLS

AND SALADS	
Work Code	Description
722320	Caterers
722513	Limited-Service Restaurants

Airport Concessions DBEs

A & ASSOCIATES INC D/BA/ A&A SERVICES	ANDREW LUCHEY	Minority Male Owned/Black
951 SANSBURY'S WAY STE 203 West Palm Beach , FL 33411	Phone: (561)533-5303 Fax: (561)533-3858 Email: CERTS@AASERVICES.CO	Contractor # 03877 Website: https://aaservices.co

Business Description: TEMPORARY STAFFING/SECURITY SERVICES

Work Code	Description
561312	Executive Search Services
621610	Home Health Care Services
541612	Human Resources Consulting Services
561110	Office Administrative Services
423990	Other Miscellaneous Durable Goods Merchant Wholesalers
813319	Other Social Advocacy Organizations
561612	Security Guards and Patrol Services
561320	Temporary Help Service

Airport Vending, Inc.	Jeffery DuPont	Minority Male Owned/Native American
P.O. Box 3450 Alpine, WY 82138 Physical: 28 Larkspur Circle 4, Alpine	Phone: (307)413-4438 Fax: (307)739-8864 Email: jeffjdupont@gmail.com	Contractor # 02883 Website:

Business Description: ACDBE: Beverage and snack vending for airports and business locations.

Work Code	Description
454210	Vending Machine Operators

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle	Darrell Searcy	Minority Male Owned/Black
310 Vizcaya Drive Palm Beach Gardens, FL 33418	Phone: (404)643-9747 Fax: (561)630-5885 Email: Darrell@chandlercampbelle.com	Contractor # 03882 Website: ccdglobal.org

Business Description: MANAGEMENT CONSULTING TRAINING PROJECT MANAGEMENT ADVERTISING IT SERVICES AND STAFFING MERCHANT WHOLESALER

Work Code	Description
541611	Administrative Management and General Management Consulting Services
485999	All Other Transit and Ground Passenger Transportation
811192	Car Washes
541513	Computer Facilities Management Services
541512	Computer Systems Design Services
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers
561210	Facilities Support Services
722310	Food Service Contractors
722511	Full-Service Restaurants
453220	Gift, Novelty, and Souvenir Stores
561720	Janitorial Services
722513	Limited-Service Restaurants
423310	Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers
561110	Office Administrative Services
488119	Other Airport Operations
423690	Other Electronic Parts and Equipment Merchant Wholesalers
423490	Other Professional Equipment and Supplies Merchant Wholesalers
541690	Other Scientific and Technical Consulting Services
541890	Other Services Related to Advertising

611430	Professional and Management Development Training
541820	Public Relations Agencies
561320	Temporary Help Service

Diversity Food Brands LLC	Jeffery Keys	Minority Male Owned/Black
53 Stonebridge Road Montclair, NJ 07042	Phone: (917)690-6463 Fax: Email: jkeys@diversityfoodbrands.com	Contractor # 03597 Website:

Business Description: ACDBE - Food service operator and licensor, airport concessionaire. www.diversityfoodbrands.com

Work Code	Description
541611	Administrative Management and General Management Consulting Services
722513	Limited-Service Restaurants
561110	Office Administrative Services
454210	Vending Machine Operators

Heart Totes LLC	Christine Symonds	Non-Minority Woman Owned/Non-Minority Women
4140 Sandy Creek Lane Jackson, WY 83002	Phone: (307)690-2560 Fax: Email: hello@heart-totes.com	Contractor # Website:

Business Description: Sells wholesale and OTC customizable tote bags with I heart designs.

Work Code	Description
455219	All Other General Merchandise Retailers
458110	Clothing and Clothing Accessories Retailers
445131	Convenience Retailers
458320	Luggage and Leather Goods Retailers

La Vie Home, Inc. dba La Vie Development, Inc.	Tonya Lewter	Minority Woman Owned/Black
1840 Wisteria Circle Bellport, NY 11713	Phone: (631)655-3280 Fax: Email: tlewter@laviedevelopment.com	Contractor # 03834 Website:

Business Description: La Vie Home, Inc. dba La Vie Development, Inc. is a Certified MWBE/ACDBE/DBE/WOSB & WBENC, HUD Section 3 Business Development Firm. The company was incorporated on June 9, 2006. Our core competency is Electric Vehicle Charging Stations' Equipment, Installation and Maintenance Services.

Work Code	Description
561110	Business Management Services
488190	Other Support Activities for Air Transportation
541720	Research and Development in the Social Sciences and Humanities

Lead at Any Level, LLC	Amy C. Waninger	Non-Minority Woman Owned/Non-Minority Women
13009 Fairfax Ct Mccordsville, IN 46055	Phone: (317)989-9600 Fax: (413)451-3767 Email: amy@leadatanylevel.com	Contractor # 03864 Website:

Business Description: Lead at Any Level, LLC specializes in inclusive leadership assessments, advisory services, and leadership development programs. We are confident that our expertise and experience will allow us to make valuable contributions to DBE and ACDBE projects in your jurisdiction.

Work Code	Description
541611	Administrative Management and General Management Consulting Services
323117	Books Printing
711510	Independent Artists, Writers, and Performers
541618	Other Management Consulting Services
611430	Professional and Management Development Training

Lenzie Henderson, LLC	Lenzie Henderson	Non-Minority Woman Owned/Non-Minority Women
15110 Kestrelglen Way Lithia, FL 33606	Phone: (985)817-0586 Fax: Email: lenzie.henderson@me.com	Contractor # 3804 Website:

Business Description: A Female owned consulting and training company. Providing one on counter sales training services in the rental car industry. Sales and compliance training in a one to one ratio or classroom training. Working with clients nationwide to training and maintain knowledgeable

staff. On location airport training is key to a successful counter where business continues to grow and customers leave happy.

Work Code	Description
611430	Professional and Management Development Training

Leslie Saunders Insurance Agency, Inc. | Quincy Branch | Minority Male Owned/Black

4584 North Rancho Drive
Las Vegas, NV 89130

Phone: (702)646-2082
Fax:
Email: qbranch@lesliesaunders.com

Contractor # 03423
Website:

Business Description: ACDBE: Insurance agency and professional development training for airport rental car agencies. www.lesliesaunders.com

Work Code	Description
524298	All Other Insurance Related Activities
541612	Human Resources Consulting Services
524210	Insurance Agencies and Brokerages
541613	Marketing Consulting Services
488190	Other Support Activities for Air Transportation
611430	Professional and Management Development Training

Longhouse Inventory Solutions, Inc. | Jami Jones | Minority Woman Owned/Native American

P.O. Box 1212
Claremore, OK 74017
Physical: 21052 S. 4175 Rd

Phone: (918)342-3127
Fax: (918)342-2423
Email: jami@lisstore.com

Contractor # 03518
Website: www.lisstore.com

Business Description: ACDBE: Supplier of child safety seats, car seat storage bags, security loops, dapple cleaner, locking clips, specialty sign bases and trolly frames. Manufacturer of security key drops. www.lisstore.com

Work Code	Description
423390	Other Construction Material Merchant Wholesalers
332439	Other Metal Container Manufacturing

M.S. Clark Enterprises, Inc., DBA Nationwide Parking Services, Inc. | Angela Clark | Minority Woman Owned/Black

1400 16th Street Suite 400
Denver, CO 80202

Phone: (800)291-8237
Fax: (888)761-8959
Email: aclark@nwprk.com

Contractor # 03879
Website: https://www.nwprk.com/

Business Description: Staffing, Transportation and Parking Management Services

Work Code	Description
485999	Airport shuttle services
812930	Parking Lots and Garages
812930	Parking services, valet

Marr Arnold Planning, LLC | Summer Marr | Non-Minority Woman Owned/Non-Minority Women

1328 California Ave.
Ames, IA 50014

Phone: (515)231-0344
Fax: http://www.marrarnoldpl(ann)ing-.com
Email: summer@marrarnoldplanning.com

Contractor # 03552
Website: http://marrarnoldplanning.com/

Business Description: ACDBE: Aviation planning, project management, environmental analysis, FAA compliance planning, research and support services. www.marrarnoldplanning.com

Work Code	Description
541611	Administrative Management and General Management Consulting Services
488190	Other Support Activities for Air Transportation

National Essentials, LLC, DBA See's Candies, Colorado Lottery, Route 70 | Kara Dar | Non-Minority Woman Owned/Non-Minority Women

274 S. Olive Street
Denver, CO 80224

Phone: (303)807-0298
Fax:
Email: karadar76@yahoo.com

Contractor # 03888
Website:

Business Description: Airport Concession Retail (Beauty Accessories, Skin Care and Travel Accessories)

Work Code	Description
458110	Apparel accessory stores
458110	Apparel stores, womens and girls clothing
445292	Confectionery and Nut Retailers

445292	Confectionery stores, packaged, retailing only

Nexus AEC, LLC DBA Titan AEC	Shobhit Baadkar	Minority Male Owned/Asian Indian
633 W. 5th Street 26th Floor Los Angeles, CA 90071	Phone: (310)651-6867 Fax: Email: sbaadkar@titanaec.com	Contractor # 03855 Website:

Business Description: Professional consulting firm providing services for building informationmodeling (BIM), virtual design & construction (VDC), LiDAR, geographicalinformation systems (GIS), project management, program management, andstaff augmentation

Work Code	Description
541513	Computer Facilities Management Services
541512	Computer Systems Design Services
611420	Computer Training
541340	Computer-Aided Design and Drafting Services
541511	Custom Computer Programming Services

OMG It's Gluten Free, LLC	Julie Scianna	Non-Minority Woman Owned/Non-Minority Women
10319 Vans Dr. Unit A Frankfort, IL 60423	Phone: (815)469-4900 Fax: Email: julie@omgitsglutenfree.com	Contractor # Website:

Business Description: Small manufacturer selling to direct and wholesale buyers across the United States. Products include pizzas, baked goods, breads, and various entrees that serve customers with a wide variety of food allergies. All of our products are 100% gluten free and nut free, and some products are dairy free, sugar free, and vegan.

Work Code	Description
311811	Bakeries with Baking from Flour on the Premises; Retailing not for Immediate Consumption
424490	Bakery Products (Except Frozen) Merchant Wholesaler; Bread Packaged (Except Frozen) Merchant Wholesaler; Health Food (Except Fresh Fruits, Vegetables) Merchant Wholesaler; Prepared Foods (Except Frozen) Merchant Wholesaler
311812	Commercial Bakeries
311821	Cookies & Cracker Manufacturing
311991	Perishable Prepared Food Manufacturing

PureSky, LLC	Justin Clayborne	Minority Male Owned/Black
525 W. Main Street, Suite 105 Belleville, IL 62220	Phone: (404)938-3342 Fax: Email: justin@pureskyllc.com	Contractor # 03836 Website:

Business Description: Credit card processing services; Financial Transactions Processing, Reserve, and Clearinghouse Activities; Administrative Management and General Management Consulting Services

Work Code	Description
541611	Administrative Management and General Management Consulting Services
522320	Credit card processing services

Southern Partners, Inc.	Nicole Sias	Minority Male Owned/Black
638 Camino De Los Mares Ste. H150-450 San Clemente, CA 92673 Physical: 999 Corporate Dr. Ste 100	Phone: (714)501-2778 Fax: Email: msias@southern-partners.com	Contractor # 03756 Website:

Business Description: Marketer of power, crude oil and natural gas as well as other petroleum products and renewables.

Work Code	Description
541690	Other Scientific and Technical Consulting Services
424720	Petroleum and Petroleum Products Merchant Wholesalers (except bulk stations and terminals)
425120	Wholesale Trade Agents and Brokers

SRL Enterprises LLC	Romaine Lewis	Minority Male Owned/Black
111 Town Square Place Suite 1203 Jersey City, NJ 073310	Phone: (877)726-0272 Fax: 2016087890;https://www.srlente(rpr)ise-s.co Email: rolewis@srlenterprises.com	Contractor # 03853 Website:

Business Description: Consultants: Contract Compliance Integrity Monitorng Oversight and Reporting DBE, MBE, MWBE, and SBE program development Certification and management community outreach and marketing services

Work Code	Description
541611	Administrative Management and General Management Consulting Services

541990	All Other Professional, Scientific, and Technical Services
541720	Business research and development services
541612	Human Resources Consulting Services
541613	Marketing Consulting Services
541618	Other Management Consulting Services

The Quotient Group	Kimberly Sippola	Non-Minority Woman Owned/Non-Minority Women
N1374 Tuckaway Ct Greenville, WI 54942	Phone: (920)809-4550 Fax: Email: kim@thequotientgroup.com	Contractor # 03690 Website:

Business Description: ACDBE. Full service aviation and transit marketing agency specializing in strategic development, market research, branding, marketing support, promotions, internal & crisis communication, website design and graphic design. www.thequotientgroup.com

Work Code	Description
541810	Advertising Agencies
541613	Marketing Consulting Services
541910	Marketing Research and Public Opinion Polling
541820	Public Relations Agencies

THE W GROUP CONSULTING FIRM, LLC	WENDY ANDERSON	Minority Woman Owned/Black
8815 CONROY WINDERMERE ROAD SUITE 212 Orlando, FL 32835	Phone: (407)502-3175 Fax: (407)320-7224 Email: WENDY@THEWGCFIRM.COM	Contractor # 03873 Website:

Business Description: RETAIL, FOOD AND BEVERAGE AND BUSINESS MANAGEMENT AND CONSULTING SERVICES

Work Code	Description
541611	Administrative Management and General Management Consulting Services
455219	All Other General Merchandise Retailers
459210	Book Retailers and News Dealers
445131	Convenience Retailers
722511	Full-Service Restaurants
453220	Gift, Novelty, and Souvenir Stores
541613	Marketing Consulting Services
541820	Public Relations Agencies

TrendTech Logistics LLC	Reginald Smith	Minority Male Owned/Black
2959 Chapel Hill Road #1259 Douglasville, GA 30135	Phone: (260)579-8742 Fax: (770)947-0856 Email: reginald.smith@trendtechlogistics.com	Contractor # 3894 Website: https://www.trendtechlogistics.com/

Business Description: Freight transportation and administrative management

Work Code	Description
541611	Administrative Management and General Management Consulting Services
561499	All Other Business Support Services
488510	Freight Transportation Arrangement
561110	Office Administrative Services
541618	Other Management Consulting Services

US ATM Network, Inc, dba US Payment Network	Kimberly McKiinley	Minority Woman Owned/Hispanic
P.O. Box 259 Balsalt, CO 81621 Physical: 1229 Green Meadow Road	Phone: (970)379-4559 Fax: Email: kmckinley@usatmnet.com	Contractor # 03827 Website: https://www.usatmnet.com/

Business Description: US ATM Network, Inc. is a full service independent ATM deployer. We provide end-to-end ATM and cash management services for airports, municipalities, banks, hotels, convenience stores, grocery stores, restaurants, retail stores, and more. We own and operate ATM terminals in 20 states and we are in partnership with federally chartered banks including US Bank, Zions Bank, Pueblo Bank & Trust, Meta Bank, Wilmington Federal Savings, Alpine Bank, Bank of Albuquerque and other local financial institutions. US ATM Network, Inc. operates in partnership with nationwide carrier management and ATM service and repair companies to coordinate cash logistics, replenishment, service and repairs. Our partners are among the largest carriers and service companies which include Loomis, Burroughs, Guarda, Sectran.

Work Code	Description
238290	ATMs (automated teller machines) installation
522320	Automated Teller Machine (ATM) or Automated Loan Machine (ALM) network operation

522320	Credit card processing services
522320	Electronic financial payment services
522320	Financial transactions processing (except central bank)

WING BOYS DELI INC	AngelicaTorres	Minority Woman Owned/Hispanic
8013 Citrus park town center Tampa, FL 33625	Phone: (813)546-4927 Fax: (813)237-4654 Email: INFO@WINGBOYS100.COM;wingboyz100@gmail.com	Contractor # 03858 Website: www.wingboys100.com/

Business Description: LIMITED-SERVICE RESTAURANT SERVING OVER 100 FLAVORS OF WINGS, QUESADILLAS, WRAPS, FRIES, CHICKEN BOWLS AND SALADS

Work Code	Description
722320	Caterers
722513	Limited-Service Restaurants

Wyoming SRF DBE Directory
Work Code Listing
January, 2026

The information within the directory is not a guarantee of the DBE's capacity and ability to perform work. This list is the most current list available to the SRF program of once certified DBEs. It may be utilized to meet the EPA Six Good Faith Efforts and does not represent any current DOT or other agency certified DBEs.

Adhesives for Bridge Related Construction and Repair (424690)

Crossroads Highway Products, LLC

Administrative Management and General Management Consulting Services (541611)

Automated Enterprise, LLC

Blu Chip Consulting, LLC

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Diversity Food Brands LLC

Entitlement & Engineering Solutions, Inc.

Ethel G. Rubio, Assoc. AIA

GIL BERRY AND ASSOCIATES

HR Consultants, Inc.

Lead at Any Level, LLC

Linear A, LLC

Lumenor Consulting Group, Inc

Marr Arnold Planning, LLC

Mary A. Lynch

PARALEGAL CONSULTANTS, LLC

Probity Professional Technical Writing, L.L.C.

Project Solutions, Inc.

PureSky, LLC

River Street Group, LLC

SRL Enterprises LLC

STEVE POLICAR LLC

Synergy Systems & Services, Inc.

The Aviation Planning Group, LLC

THE W GROUP CONSULTING FIRM, LLC

Transportation Management & Design, Inc.

TrendTech Logistics LLC

Unison Consulting, Inc.

Advertising Agencies (541810)

SENSIS INC.

The Quotient Group

Airport shuttle services (485999)

M.S. Clark Enterprises, Inc., DBA Nationwide Parking Services, Inc.

All Other Business Support Services (561499)

Linear A, LLC

TrendTech Logistics LLC

All Other General Merchandise Retailers (455219)

Heart Totes LLC

THE W GROUP CONSULTING FIRM, LLC

All Other Insurance Related Activities (524298)

Leslie Saunders Insurance Agency, Inc.

All Other Legal Services (541199)

PARALEGAL CONSULTANTS, LLC

All Other Miscellaneous Electrical Equipment and Component Manufacturing (335999)

Sub Con Manufacturing Corp.

All Other Miscellaneous Fabricated Metal Product Manufacturing (332999)

North American Safety Products, Inc.

Pikes Peak Steel LLC

All Other Miscellaneous Schools and Instruction (611699)

GIL BERRY AND ASSOCIATES

All Other Miscellaneous Textile Product Mills (314999)

Cole's Screen Printing

All Other Professional, Scientific, and Technical Services (541990)

Entitlement & Engineering Solutions, Inc.

Lark Environmental, Inc.

Lumenor Consulting Group, Inc

SRL Enterprises LLC

All Other Specialty Trade Contractors (238990)

Asphalt Plus, Inc.

CENTENNIAL TRUCKING, INC.

Contractor Services Inc

Geranios Enterprises, Inc.

Hardrives Construction, Inc.

K & S Brady Construction LLC

Kirk Barnes Construction, Inc.

Surface Prep and Maintenance

The Art of Concrete, LLC

All Other Support Services (561990)

Doss Technical Services, LLC

Nunn Utility Locating, LLC

The Aviation Planning Group, LLC

TYLER COMMUNICATIONS INC.

All Other Telecommunications (517810)

EJO Ventures, LLC

All Other Transit and Ground Passenger Transportation (485999)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Apparel accessory stores (458110)

National Essentials, LLC, DBA See's Candies, Colorado Lottery, Route 70

Apparel stores, womens and girls clothing (458110)

National Essentials, LLC, DBA See's Candies, Colorado Lottery, Route 70

Architectural Services (541310)

Trails West Architecture, LLC

Asphalt Paving (i.e., highway, road, street, public sidewalk) (237310)

Alexander Construction Co.

Asphalt Plus, Inc.

Hardrives Construction, Inc.

Intermountain Builders

Pavement Solutions, Inc.

Straight Stripe Painting, Inc.

Surface Prep and Maintenance

ATMs (automated teller machines) installation (238290)

US ATM Network, Inc, dba US Payment Network

Automated Teller Machine (ATM) or Automated Loan Machine (ALM) network operation (522320)

US ATM Network, Inc, dba US Payment Network

Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use (334512)

Sub Con Manufacturing Corp.

Bakeries with Baking from Flour on the Premises; Retailing not for Immediate Consumption (311811)

OMG It's Gluten Free, LLC

Bakery Products (Except Frozen) Merchant Wholesaler; Bread Packaged (Except Frozen) Merchant Wholesaler; Health Food (Except Fresh Fruits, Vegetables) Merchant Wholesaler; Prepared Foods (Except Frozen) Merchant Wholesaler (424490)

OMG It's Gluten Free, LLC

Book Retailers and News Dealers (459210)

THE W GROUP CONSULTING FIRM, LLC

Books Printing (323117)

Lead at Any Level, LLC

Brick, Stone, and Related Construction Material Merchant Wholesalers (423320)

Allsource Construction Supply

B & B Enterprises, LLC

Crossroads Highway Products, LLC

GIL BERRY AND ASSOCIATES

Kirk Barnes Construction, Inc.

Rhodes Rebar Detailing and Estimating LLC

Surface Prep and Maintenance

Bridge Construction (237310)

NPW Contracting, Inc. dba HJR Supply, Inc.

Pikes Peak Steel LLC

Rhodes Rebar Detailing and Estimating LLC

Bridge painting (238320)

Coating Specialist, LLC

Building Inspection Services (541350)

PAJARDO ELECTRIC CO., INC.

Business Management Services (561110)

La Vie Home, Inc. dba La Vie Development, Inc.

Business research and development services (541720)

SRL Enterprises LLC

Unison Consulting, Inc.

Car Washes (811192)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Caterers (722320)

WING BOYS DELI INC

Civil Engineering Services (541330)

Entitlement & Engineering Solutions, Inc.

Navjoy Consulting Services, Inc.

NLD Engineering, Inc.

Phoenix Engineering, Inc.

Claims Adjusting (524291)

JMAC GROUP LLC, DBA CRAFT SAFETY INSPECTIONS & Craft Safety Industries

Clothing and Clothing Accessories Retailers (458110)

Heart Totes LLC

Commercial and Institutional Building Construction (236220)

Eagle Rock Timber, Inc.

Haass Construction Co., Inc.

Commercial Bakeries (311812)

OMG It's Gluten Free, LLC

Commercial Gravure Printing (323111)

Cole's Screen Printing

Commercial Printing (except Screen and Books) (323111)

Marathon Reprographics Inc DBA MySmartPlans

Commercial screen printing (323113)

Cole's Screen Printing

Computer and Computer Peripheral Equipment and Software Merchant Wholesalers (423430)

Cinga Technologies, LLC

GIL BERRY AND ASSOCIATES

Computer Facilities Management Services (541513)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Nexus AEC, LLC DBA Titan AEC

Synergy Systems & Services, Inc.

Computer Storage Device Manufacturing (334112)

Cinga Technologies, LLC

Computer Systems Design Services (541512)

Avero, LLC

Blu Chip Consulting, LLC

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

EJO Ventures, LLC

Keleusmatic Technologies

Livingston Rail LLC, DBA Livingston Rail

Lumenor Consulting Group, Inc

Marathon Reprographics Inc DBA MySmartPlans

Navjoy Consulting Services, Inc.

Nexus AEC, LLC DBA Titan AEC

Synergy Systems & Services, Inc.

Unison Consulting, Inc.

Computer Terminal and Other Computer Peripheral Equipment Manufacturing (334118)

Cinga Technologies, LLC

Computer Training (611420)

Marathon Reprographics Inc DBA MySmartPlans

Nexus AEC, LLC DBA Titan AEC

Unison Consulting, Inc.

Computer-Aided Design and Drafting Services (541340)

Austell A Engineering, LLC

Nexus AEC, LLC DBA Titan AEC

Computing Infrastructure Providers, Data Processing, Web Hosting, and Related Services (518210)

SENSIS INC.

Concrete coating, glazing or sealing (238390)

Coating Specialist, LLC

Guytec Steel Inc.

Concrete Mixtures (423320)

Crossroads Highway Products, LLC

Concrete Paving (i.e., highway, road, street, public sidewalk) (237310)

Alexander Construction Co.

Asphalt Plus, Inc.

Intermountain Builders

Pavement Solutions, Inc.

The Art of Concrete, LLC

Confectionery and Nut Retailers (445292)

National Essentials, LLC, DBA See's Candies, Colorado Lottery, Route 70

Confectionery stores, packaged, retailing only (445292)

National Essentials, LLC, DBA See's Candies, Colorado Lottery, Route 70

Construction and Mining (except Oil Well) Machinery and Equipment Merchant Wholesalers (423810)

Full Moon Enterprises, LLC

McCall Industrial Supply

Construction estimation services (541990)

Kirschner Contractors

Construction Management, Highway, Road, Street and Bridge (237310)

Kirschner Contractors

Navjoy Consulting Services, Inc.

Phoenix Engineering, Inc.

Preferred Construction Mgt Co., Inc.

Shrewsberry & Associates, LLC

Construction management, industrial building (except warehouses (236210)

Kirschner Contractors

Preferred Construction Mgt Co., Inc.

Construction management, mass transit (237990)

Kirschner Contractors

Preferred Construction Mgt Co., Inc.

Construction management, water and sewage treatment plant (237110)

Kirschner Contractors

Construction management, water and sewer line (237110)

Kirschner Contractors

Preferred Construction Mgt Co., Inc.

Construction Sand & Gravel Mining (212321)

Aggregate Logistics, LLC

Alexander Construction Co.

B & B Enterprises, LLC

Rocky Mountain Sand & Gravel, LLC

Skyview Excavating and Grading, Inc.

Construction Surveying Services (541370)

Lumenor Consulting Group, Inc

Contract Staffing Services (561320)

SAMPATH, THAMARAI S DBA Logg

Convenience Retailers (445131)

Heart Totes LLC

THE W GROUP CONSULTING FIRM, LLC

Convention and Trade Show Organizers (561920)

PARALEGAL CONSULTANTS, LLC

Cookies & Cracker Manufacturing (311821)

OMG It's Gluten Free, LLC

Credit card processing services (522320)

PureSky, LLC

US ATM Network, Inc, dba US Payment Network

Custom Computer Programming Services (541511)

Livingston Rail LLC, DBA Livingston Rail

Marathon Reprographics Inc DBA MySmartPlans

Nexus AEC, LLC DBA Titan AEC

SENSIS INC.

Synergy Systems & Services, Inc.

Cut and Sew Apparel Manufacturing (except Contractors) (315250)

Cole's Screen Printing

Display Advertising (541850)

Cole's Screen Printing

Document Preparation Services (561410)

Marathon Reprographics Inc DBA MySmartPlans

Drywall and Insulation Contractors (238310)

GIL BERRY AND ASSOCIATES

Educational Support Services (611710)

Educators 4 Education

HR Consultants, Inc.

TYLER COMMUNICATIONS INC.

Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers (423610)

Allsource Construction Supply

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Gil's Sales Co. Inc. dba GSC Lighting & Supply

Meltar Supply LLC

PAJARDO ELECTRIC CO., INC.

WIDEFIELD TECHNOLOGY, INC.

Electrical Contractors and Other Wiring Installation Contractors (238210)

EJO Ventures, LLC

Keleusmatic Technologies

NORTH/WESTERN ELECTRICAL CORPORATION OF COLORADO

PAJARDO ELECTRIC CO., INC.

Electrical repair shops, automotive (811114)

Moore Installs LLC

Electromedical and Electrotherapeutic Apparatus Manufacturing (334510)

Sub Con Manufacturing Corp.

Electronic Computer Manufacturing (334111)

Cinga Technologies, LLC

Electronic financial payment services (522320)

US ATM Network, Inc, dba US Payment Network

Engineering Services (541330)

Geocal, Inc.

Harmony Design, Inc.

Livingston Rail LLC, DBA Livingston Rail

NLD Engineering, Inc.

Professional Engineering Services, Ltd.

Project Solutions, Inc.

Shrewsberry & Associates, LLC

Venture Services LLC

Environmental Consulting Services (541620)

Atlantic Petroleum and Mineral Resources, Inc,

BMP Environmental Consultants, Inc.

GIL BERRY AND ASSOCIATES

Hydro Logic, LLC

JMAC GROUP LLC, DBA CRAFT SAFETY INSPECTIONS & Craft Safety Industries

Lark Environmental, Inc.

Linear A, LLC

Lumenor Consulting Group, Inc

Natural System Analysts, Inc.

Paul Carpenter Associates, Inc

Peak Environmental Management, Inc

Real West Natural Resource Consulting

Shrewsberry & Associates, LLC

Terranext, LLC

The Aviation Planning Group, LLC

Excavation Contractors (238910)

Asphalt Plus, Inc.

B. Fritch Trucking

Barnum, Inc.

Skyview Excavating and Grading, Inc.

Executive Search Services (561312)

A & ASSOCIATES INC D/BA/ A&A SERVICES

Fabricated Structural Metal Manufacturing (332312)

Guytec Steel Inc.

Pikes Peak Steel LLC

Serrmi Products, LLC

Willamette Technical Fabricators

Facilities Support Services (561210)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Farm Supplies Merchant Wholesalers (424910)

Rare Agricultural Products, LLP

Fencing Contractors (except electronic containment fencing for pets) (238990)

Alexander Construction Co.

K & S Brady Construction LLC

K's Construction, Inc.

King Enterprises

P & E Painting and Lead Removal

Pikes Peak Steel LLC

Financial transactions processing (except central bank) (522320)

US ATM Network, Inc, dba US Payment Network

Flagging (i.e., traffic control) Services (561990)

Advanced Traffic Services, LLC

B & B Enterprises, LLC

Contractor Services Inc

Idaho Traffic Safety, Inc.

JMAC GROUP LLC, DBA CRAFT SAFETY INSPECTIONS & Craft Safety Industries

Straight Stripe Painting, Inc.

Traffic Services Company, LLC

Flat Glass Manufacturing (327211)

Invision Smart Window, LLC

Food Service Contractors (722310)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

EJO Ventures, LLC

Framing Contractors (238130)

Barnum, Inc.

Freight Transportation Arrangement (488510)

CELESTIAL FREIGHT SOLUTIONS, INC.

ROLLING BLUE LOGISTICS LLC

TrendTech Logistics LLC

Full-Service Restaurants (722511)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

THE W GROUP CONSULTING FIRM, LLC

General Freight Trucking, Local (484110)

LYNX, LLC

Surface Prep and Maintenance

Gift, Novelty, and Souvenir Stores (453220)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

THE W GROUP CONSULTING FIRM, LLC

Glass and Glazing Contractors (238150)

Invision Smart Window, LLC

Glass Product Manufacturing Made of Purchased Glass (327215)

Invision Smart Window, LLC

Grading Construction Sites (238910)

Alexander Construction Co.

Skyview Excavating and Grading, Inc.

Grading, Highway, Road, Street and Airport Runway (237310)

Hardrives Construction, Inc.

Guardrail Construction (237310)

K's Construction, Inc.

King Enterprises

P & E Painting and Lead Removal

Pikes Peak Steel LLC

S & L Industrial

Straight Stripe Painting, Inc.

Hardware Merchant Wholesalers (423710)

Allsource Construction Supply

Hazardous Waste Collection (562112)

Atlantic Petroleum and Mineral Resources, Inc,

Hazardous Waste Treatment and Disposal (562211)

Atlantic Petroleum and Mineral Resources, Inc,

Highway, Street, and Bridge Construction (237310)

Asphalt Plus, Inc.

Austell A Engineering, LLC

Barnum, Inc.

COLDWATER GROUP, INC.

Crossroads Highway Products, LLC

Eagle Rock Timber, Inc.

Geranios Enterprises, Inc.

Hardrives Construction, Inc.

Hudson, Inc.

Intermountain Builders

K's Construction, Inc.

King Enterprises

Kirk Barnes Construction, Inc.

Koppel Fabrication, Inc.

Pikes Peak Steel LLC

S & L Industrial

Home Health Care Services (621610)

A & ASSOCIATES INC D/BA/ A&A SERVICES

Human Resources Consulting Services (541612)

A & ASSOCIATES INC D/BA/ A&A SERVICES

HR Consultants, Inc.

Leslie Saunders Insurance Agency, Inc.

SRL Enterprises LLC

Hydroseeding Services (e.g., decorative, erosion control purposes) (561730)

Hydro Logic, LLC

Professional Landscaping, Inc.

Independent Artists, Writers, and Performers (711510)

Lead at Any Level, LLC

Industrial Building Construction (236210)

Kirk Barnes Construction, Inc.

Industrial Machinery and Equipment Merchant Wholesalers (423830)

McCall Industrial Supply

Industrial Supplies Merchant Wholesalers (423840)

Allsource Construction Supply

McCall Industrial Supply

Meltar Supply LLC

Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals (334515)

Serrmi Products, LLC

Insurance Agencies and Brokerages (524210)

Leslie Saunders Insurance Agency, Inc.

Janitorial Services (561720)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Mary's Cleaning Service, LLC

Landscape Architectural Services (541320)

Harmony Design, Inc.

Phoenix Engineering, Inc.

Rooted Landscape Architecture, LLC

Shrewsberry & Associates, LLC

Landscaping Services (561730)

Alexander Construction Co.

K & S Brady Construction LLC

Kirk Barnes Construction, Inc.

Limited-Service Restaurants (722513)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Diversity Food Brands LLC

EJO Ventures, LLC

WING BOYS DELI INC

Luggage and Leather Goods Retailers (458320)

Heart Totes LLC

Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers (423310)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

GIL BERRY AND ASSOCIATES

Marketing Consulting Services (541613)

Kramer Associates Inc.

Leslie Saunders Insurance Agency, Inc.

Lumenor Consulting Group, Inc

Mary A. Lynch

SRL Enterprises LLC

The Quotient Group

THE W GROUP CONSULTING FIRM, LLC

Marketing Research and Public Opinion Polling (541910)

Doss Technical Services, LLC

Lumenor Consulting Group, Inc

Rhodes Rebar Detailing and Estimating LLC

Shrewsberry & Associates, LLC

Synergy Systems & Services, Inc.

The Aviation Planning Group, LLC

The Quotient Group

Masonry Contractors (238140)

Rhodes Rebar Detailing and Estimating LLC

Media Buying Agencies (541830)

SENSIS INC.

Metal Tank (Heavy Gauge) Manufacturing (332420)

Hudspeth and Associates Inc

New Multifamily Housing Construction (except for-sale builders) (236116)

Preferred Construction Mgt Co., Inc.

News Dealers and Newsstands (451212)

EJO Ventures, LLC

Nonresidential Property Managers (531312)

Unison Consulting, Inc.

Office Administrative Services (561110)

A & ASSOCIATES INC D/BA/ A&A SERVICES

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Diversity Food Brands LLC

Ethel G. Rubio, Assoc. AIA

Lark Environmental, Inc.

PARALEGAL CONSULTANTS, LLC

ROLLING BLUE LOGISTICS LLC

TrendTech Logistics LLC

TYLER COMMUNICATIONS INC.

Office Equipment Merchant Wholesalers (423420)

Cinga Technologies, LLC

Office Help Supply Services (561320)

SAMPATH, THAMARAI S DBA Logg

Offices of Certified Public Accountants (541211)

Doss Technical Services, LLC

Oil and Gas Pipeline and Related Structures Construction (237120)

Barnum, Inc.

Cooper Resources LLC.

Preferred Construction Mgt Co., Inc.

Ornamental and Architectural Metal Work Manufacturing (332323)

Koppel Fabrication, Inc.

North American Safety Products, Inc.

Pikes Peak Steel LLC

Other Accounting Services (541219)

HR Consultants, Inc.

ROLLING BLUE LOGISTICS LLC

Other Activities Related to Real Estate (531390)

GIL BERRY AND ASSOCIATES

Other Airport Operations (488119)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Mary A. Lynch

Other Building Finishing Contractors (238390)

A&E Caulking Solutions

NPW Contracting, Inc. dba HJR Supply, Inc.

The Art of Concrete, LLC

Other Building Material Dealers (444190)

Aggregate Logistics, LLC

Allsource Construction Supply

GIL BERRY AND ASSOCIATES

Gil's Sales Co. Inc. dba GSC Lighting & Supply

Meltar Supply LLC

NPW Contracting, Inc. dba HJR Supply, Inc.

Other Business Service Centers (including Copy Shops) (561439)

Marathon Reprographics Inc DBA MySmartPlans

Other Chemical and Allied Products Merchant Wholesalers (424690)

Allsource Construction Supply

Crossroads Highway Products, LLC

Other Communications Equipment Manufacturing (334290)

North American Safety Products, Inc.

Other Computer Related Services (541519)

Blu Chip Consulting, LLC

Lumenor Consulting Group, Inc

Unison Consulting, Inc.

Other Construction Material Merchant Wholesalers (423390)

Aggregate Logistics, LLC

Allsource Construction Supply

Big Knife Resources

Crossroads Highway Products, LLC

Longhouse Inventory Solutions, Inc.

Meltar Supply LLC

NPW Contracting, Inc. dba HJR Supply, Inc.

Rhodes Rebar Detailing and Estimating LLC

Other Crushed and Broken Stone Mining and Quarrying (212319)

Alexander Construction Co.

B & B Enterprises, LLC

Other Electronic Component Manufacturing (334419)

Sub Con Manufacturing Corp.

Other Electronic Parts and Equipment Merchant Wholesalers (423690)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Serrmi Products, LLC

Other Fabricated Wire Product Manufacturing (332618)

Serrmi Products, LLC

Other Foundation, Structure, and Building Exterior Contractors (238190)

Barnum, Inc.

Pikes Peak Steel LLC

Other Heavy and Civil Engineering Construction (237990)

Cooper Resources LLC.

Geranios Enterprises, Inc.

Hudspeth and Associates Inc

Kirk Barnes Construction, Inc.

Other Lighting Equipment Manufacturing (335129)

Valley Illuminators

Other Management Consulting Services (541618)

Keleusmatic Technologies

Lead at Any Level, LLC

Linear A, LLC

Lumenor Consulting Group, Inc

Mary A. Lynch

Navjoy Consulting Services, Inc.

Shrewsberry & Associates, LLC

SRL Enterprises LLC

The Aviation Planning Group, LLC

TrendTech Logistics LLC

WIDEFIELD TECHNOLOGY, INC.

Other Metal Container Manufacturing (332439)

Longhouse Inventory Solutions, Inc.

Other Miscellaneous Durable Goods Merchant Wholesalers (423990)

A & ASSOCIATES INC D/BA/ A&A SERVICES

Idaho Traffic Safety, Inc.

Valley Illuminators

Other Nonhazardous Waste Treatment and Disposal (562219)

Atlantic Petroleum and Mineral Resources, Inc,

Other Professional Equipment and Supplies Merchant Wholesalers (423490)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Other Scientific and Technical Consulting Services (541690)

Austell A Engineering, LLC

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

GIL BERRY AND ASSOCIATES

Harmony Design, Inc.

Hydro Logic, LLC

JKH Consulting

JMAC GROUP LLC, DBA CRAFT SAFETY INSPECTIONS & Craft Safety Industries

Kramer Associates Inc.

Linear A, LLC

Lumenor Consulting Group, Inc

Navjoy Consulting Services, Inc.

Peak Environmental Management, Inc

Shrewsberry & Associates, LLC

Southern Partners, Inc.

Unison Consulting, Inc.

WIDEFIELD TECHNOLOGY, INC.

Other Services Related to Advertising (541890)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Cole's Screen Printing

Other Social Advocacy Organizations (813319)

A & ASSOCIATES INC D/BA/ A&A SERVICES

Other Support Activities for Air Transportation (488190)

La Vie Home, Inc. dba La Vie Development, Inc.

Leslie Saunders Insurance Agency, Inc.

Marr Arnold Planning, LLC

Mary A. Lynch

Other Support Activities for Road Transportation (488490)

Atlantic Petroleum and Mineral Resources, Inc,

Contractor Services Inc

Kirk Barnes Construction, Inc.

Mountain West Drivers Corp.

Painting (except roof) contractors (238320)

Coating Specialist, LLC

Painting and Wall Covering Contractors (238320)

FDT Water Infrastructure LLC

P & E Painting and Lead Removal

Painting Lines on Highways, Streets and Bridges (237310)

Contractor Services Inc

Idaho Traffic Safety, Inc.

P & E Painting and Lead Removal

S & L Industrial

Straight Stripe Painting, Inc.

Traffic Services Company, LLC

Parking Lot Marking and Line Painting (237310)

Contractor Services Inc

Parking Lots and Garages (812930)

M.S. Clark Enterprises, Inc., DBA Nationwide Parking Services, Inc.

Parking services, valet (812930)

M.S. Clark Enterprises, Inc., DBA Nationwide Parking Services, Inc.

Perishable Prepared Food Manufacturing (311991)

OMG It's Gluten Free, LLC

Petroleum and Petroleum Products Merchant Wholesalers (except bulk stations and terminals) (424720)

Atlantic Petroleum and Mineral Resources, Inc,

ROLLING BLUE LOGISTICS LLC

Southern Partners, Inc.

Plastics Materials and Basic Forms and Shapes Merchant Wholesalers (424610)

McCall Industrial Supply

Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers (423720)

McCall Industrial Supply

Poured Concrete Foundation and Structure Contractors (238110)

Barnum, Inc.

Comers Concrete, LLC

Eagle Rock Timber, Inc.

Full Moon Enterprises, LLC

Geranios Enterprises, Inc.

Haass Construction Co., Inc.

Rhodes Rebar Detailing and Estimating LLC

The Art of Concrete, LLC

Power and Communication Line and Related Structures Construction (237130)

Barnum, Inc.

Cooper Resources LLC.

NORTH/WESTERN ELECTRICAL CORPORATION OF COLORADO

Prefabricated Metal Building and Component Manufacturing (332311)

Serrmi Products, LLC

Printed Circuit Assembly (Electronic Assembly) Manufacturing (334418)

Sub Con Manufacturing Corp.

Process, Physical Distribution, and Logistics Consulting Services (541614)

CELESTIAL FREIGHT SOLUTIONS, INC.

GIL BERRY AND ASSOCIATES

Lumenor Consulting Group, Inc

ROCK SOLID PROJECT SOLUTIONS INC

ROLLING BLUE LOGISTICS LLC

Shrewsberry & Associates, LLC

Transportation Management & Design, Inc.

Professional and Management Development Training (611430)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Doss Technical Services, LLC

Ethel G. Rubio, Assoc. AIA

HR Consultants, Inc.

JMAC GROUP LLC, DBA CRAFT SAFETY INSPECTIONS & Craft Safety Industries

Lead at Any Level, LLC

Lenzie Henderson, LLC

Leslie Saunders Insurance Agency, Inc.

Lumenor Consulting Group, Inc

TYLER COMMUNICATIONS INC.

Public Relations Agencies (541820)

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Ethel G. Rubio, Assoc. AIA

The Quotient Group

THE W GROUP CONSULTING FIRM, LLC

Ready-Mix Concrete Manufacturing (327320)

G & L Concrete, Inc.

Refrigeration Equipment and Supplies Merchant Wholesalers (423740)

McCall Industrial Supply

Remediation Services (562910)

Hudspeth and Associates Inc

Shrewsberry & Associates, LLC

Research and Development in the Physical, Engineering, and Life Sciences (except biotechnology) (541712)

PAJARDO ELECTRIC CO., INC.

Real West Natural Resource Consulting

Research and Development in the Social Sciences and Humanities (541720)

La Vie Home, Inc. dba La Vie Development, Inc.

Residential Remodelers (236118)

Hudspeth and Associates Inc

Resurfacing, Highway, Road, Street, Bridge or Airport Runway (237310)

Coating Specialist, LLC

Roofing contractors (238160)

GIL BERRY AND ASSOCIATES

Roofing, Siding, and Insulation Material Merchant Wholesalers (423330)

Allsource Construction Supply

GIL BERRY AND ASSOCIATES

Meltar Supply LLC

Runway, Airport, Line Painting (e.g. Striping) (237310)

Surface Prep and Maintenance

Sandblasting, building exterior (238390)

Coating Specialist, LLC

Satellite Telecommunications (517410)

EJO Ventures, LLC

Security Guards and Patrol Services (561612)

A & ASSOCIATES INC D/BA/ A&A SERVICES

Security Systems Services (except Locksmiths) (561621)

EJO Ventures, LLC

Sign Erection, Highway, Roads Street or Bridge (237310)

Advanced Traffic Services, LLC

B & B Enterprises, LLC

Contractor Services Inc

King Enterprises

S & L Industrial

Straight Stripe Painting, Inc.

Traffic Services Company, LLC

Site Preparation Contractors (238910)

B. Fritch Trucking

Barnum, Inc.

Eagle Rock Timber, Inc.

Hardrives Construction, Inc.

Hudspeth and Associates Inc

Kirk Barnes Construction, Inc.

Rocky Mountain Sand & Gravel, LLC

Software Publishers (513210)

Unison Consulting, Inc.

Soil Preparation, Planting, and Cultivating (115112)

Hydro Logic, LLC

Rare Agricultural Products, LLP

Specialized Freight (except used goods) Trucking, Local (484220)

Alexander Construction Co.

B. Fritch Trucking

BD Hauling Inc.

CELESTIAL FREIGHT SOLUTIONS, INC.

JBI Trucking, LLC

Laura A. Wiedewitsch Trucking, LLC

LYNX, LLC

Skyview Excavating and Grading, Inc.

Surface Prep and Maintenance

Specialized Freight (except used goods) Trucking, Long-Distance (484230)

Aggregate Logistics, LLC

Strategic Planning Consulting Services (541611)

Guytec Steel Inc.

The Aviation Planning Group, LLC

Structural Steel and Precast Concrete Contractors (238120)

Barnum, Inc.

Black Iron Steel, LLC dba Black Iron Rebar, LLC

Eagle Rock Timber, Inc.

Guytec Steel Inc.

Kirk Barnes Construction, Inc.

Pikes Peak Steel LLC

Rhodes Rebar Detailing and Estimating LLC

Surveying and Mapping (except geophysical) Services (541370)

GIL BERRY AND ASSOCIATES

Harmony Design, Inc.

Lumenor Consulting Group, Inc

Martinez Geospatial, Inc.

Phoenix Engineering, Inc.

Synergy Systems & Services, Inc.

Tax Preparation Services (541213)

ROLLING BLUE LOGISTICS LLC

Technical Training (541690)

Austell A Engineering, LLC

Temporary Help Service (561320)

A & ASSOCIATES INC D/BA/ A&A SERVICES

Chandler & Campbelle Investment Group dba Chandler Campbelle & Daschle

Construction Recruiters America Staffing, Inc.

Doss Technical Services, LLC

ESP Enterprises, Inc.

Martinez Geospatial, Inc.

Synergy Systems & Services, Inc.

Temporary Staffing Service (561320)

SAMPATH, THAMARAI S DBA Logg

Testing Laboratories (541380)

Paul Carpenter Associates, Inc

Textile and Fabric Finishing Mills (313310)

Cole's Screen Printing

Transportation Equipment and Supplies (except motor vehicle) Merchant Wholesalers (423860)

Meltar Supply LLC

Serrmi Products, LLC

Transportation Management Consulting Services (541614)

Kramer Associates Inc.

Navjoy Consulting Services, Inc.

Urban planning services (541320)

Transportation Management & Design, Inc.

Vending Machine Operators (454210)

Airport Vending, Inc.

Diversity Food Brands LLC

Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers (423730)

Allsource Construction Supply

McCall Industrial Supply

Waste Treatment and Disposal (56221)

Atlantic Petroleum and Mineral Resources, Inc,

Water and Sewer Line and Related Structures Construction (237110)

Barnum, Inc.

Cooper Resources LLC.

Eagle Rock Timber, Inc.

FDT Water Infrastructure LLC

Hudspeth and Associates Inc

NORTH/WESTERN ELECTRICAL CORPORATION OF COLORADO

Rocky Mountain Sand & Gravel, LLC

S & L Industrial

Water Supply and Irrigation Systems (221310)

Shrewsberry & Associates, LLC

Waterproofing contractors (238390)

Coating Specialist, LLC

Wholesale Trade Agents and Brokers (425120)

Crossroads Highway Products, LLC

Meltar Supply LLC
NPW Contracting, Inc. dba HJR Supply, Inc.
Pikes Peak Steel LLC
Roadway Material Supply LLC
Southern Partners, Inc.
WIDEFIELD TECHNOLOGY, INC.
Wired Telecommunications Carriers (517110)
EJO Ventures, LLC

Affidavit Acknowledging Payment to Materialmen, Subcontractors and Laborers

[Completed form must accompany all requests for progress payments beginning with second request]

Contractor: _____

Owner: _____

Project: _____

[Before Owner may issue a progress payment, W.S. 16-6-1001(a)(iv) requires verification that all materialmen, subcontractors, and laborers have been paid for completed work through the date of the most recent previous progress payment. W.S. 16-6-1001(a)(iv) also requires that progress payments withheld by Contractor due to a reasonable dispute between Contractor and a materialman, subcontractor or laborer shall not be paid to Contractor but shall be retained in accordance with the guidelines addressing disputed final payment under the provisions of W.S. 16-6-117.]

I, _____, hereby certify to the best of my knowledge, information, and belief, and on penalty of false swearing, that:

- I am authorized to sign this affidavit on Contractor's behalf as Contractor's Representative.

- Other than the reasonable disputes listed and described in this affidavit, all materialmen, subcontractors, and laborers have been paid according to their respective contracts for the work or services they performed, or materials they provided for the above-referenced project through _____, 20____ (the date of the most recent previous progress payment).

- The funds for the disputes described in this affidavit are not included in the current progress payment request submitted with this affidavit, and are not included in the total amount claimed in that request as work completed.

Disputes: (If none, write "None." Attach additional pages as necessary.)

Name of Entity	Amount Not Paid	Reason Funds Not Paid
-		
-		

Total Amount Not Paid $_____

_____ _____

Signature of Contractor's Representative Date

_____

Name and Title of Contractor's Representative

STATE OF _____)
COUNTY OF _____)

The foregoing instrument was acknowledged before me by _____
this _____ day of _____, 20___.

Witness my hand and official seal.

_____

Notarial Officer

My commission expires: _____

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"General Decision Number: WY20260044 01/02/2026

Superseded General Decision Number: WY20250044

State: Wyoming

Construction Types: Heavy and Highway

Counties: Albany, Big Horn, Campbell, Carbon, Converse, Crook, Fremont, Goshen, Hot Springs, Johnson, Lincoln, Niobrara, Park, Platte, Sheridan, Sublette, Sweetwater, Teton, Uinta, Washakie and Weston Counties in Wyoming.

Heavy and Highway Construction Projects

Modification Number	Publication Date
0	01/02/2026

SAWY2025-004 05/01/2025

	Rates	Fringes
Carpenter	$ 29.40	5.25
Concrete Finisher	$ 30.12	7.39
Electrician (Inside Wireman, Outside Lineman and Signal and Lighting work)	$ 58.83	21.89
Equipment Operator (Electrical work)	$ 48.91	20.61
Groundman (Electrical work)	$ 34.72	17.64
Ironworker	$ 46.00	0.00
Laborers (Group 1)	$ 21.68	0.00

Erector & Installer (fences, guardrail & barrier); Flag persons (traffic control); Form stripper; General laborer; Heater tender; Material checker; Pick-up truck driver; Pilot car driver; Pre-watering, presetting & pre-irrigation (all work); Riprap man; Tar & asphalt pot tender

Laborers (Group 2)	$ 22.90	4.08

Asphalt raker and tamper; Bin wall installer; Chain saw operator (clearing & grubbing); Concrete saw (all types); Form setter (paving); Hand operated vibratory roller; High scalar; Jackhammer & pavement breaker; Maintainer (Traffic Control);

Nozzle man (air, water, gunnite & sandblasting); Landscaper, landscape laborer; Mortar man on stone riprap; Tamper operator (pneumatic, electric, gas & similar); Painter (brush & spray); Pipe setter (all pipe types); Pot Tender

Laborers (Group 3).....$ 24.50 6.52
Dump man; Miner (driller), Machineman, Timberman, Steelman; Drill Doctor, Form setter and mover, Spader, Spilling and/or Caisson Worker; Powderman, Blaster, Tender; Traffic Control Supervisor; Wagon drill, air-trac., (diamond and other drills for Blasting powder or grouting).

Power Equipment Operators
(Group 1).....$ 26.90 5.13
Skid Steer (all attachments); Air Compressor (all types); Backhoes & Excavators (to 5 CY.); Batch Bin Weighman, Scissorman or Hopper; Broom Operator (self propelled); Chip Spreader Operator; Conveyor Belt Operator; Crusher Oiler; Form Grader Operator; Joint Machine Operator; Longitudinal Float Operator; Oiler, Utility; Power Loader (belt & bucket type); Pump Operator; Roller Operator, self-propelled (Dirt); Tire Repairman (large construction equip. tires); Tractor Operator (farm with/without power attachments); Tugger (all types)

Power Equipment Operators
(Group 2).....$ 28.56 8.01
Articulated Rock Truck (all capacity); Asphalt Plant Operator; Backhoe, Excavator & Shovel (5 CY. & larger); Batch Plant Operator; Bituminous Laydown Machine Operator; Concrete Batch Plant Operator; Concrete Finish Machine Operator; Concrete Spreader & Paver Operator; Concrete Multi Blade Span Saw (Hunt process); Crusher Operator; Dozer Operator (all sizes & power attachments); Drilling Machine, Integrated (core, rotary, caisson, or diamond); Draglines, Cranes, Piledriver & Truck Mounted Cranes (Mfg Rating: less than 3.5 CY. and/or less than 50 tons all attachments); Front End Loaders (up to 10 CY.); Hydro-type Crane (to 50 tons); Mixer Operator, Concrete (over 1 yd.); Motor Patrol Operator (all excluding finish); Mulching Machine Operator; Oiler (crane & shovels); Pavement Breaker, Hydro-Tamper & similar; Roller Operators, Asphalt (steel & pneumatic); Roto-Milling Machine (under 8 ft. wide); Scraper Equipment (all types and sizes); Screed Operator; Trenching Machine Operator

Power Equipment Operators
(Group 3).....$ 32.72 8.10
Draglines, Cranes, Piledrivers & Truck Mounted Cranes (Mfg. Rating: 3.5 CY. or larger, and/or 50 tons and larger all attachments); Front End Loaders (10 CY. & larger); Heavy Duty Mechanic; Welder; Hoist Operator (two or more drums, shafts,

or raises); Motor Patrol Operator (finish); Roto-Milling Machine (8 ft. & larger); Mixer Operator (dual drum)

Truck Drivers (Group 1).....$ 26.01 3.69
""A"" Frame truck driver; Coring Machine (self propelled); Dump Truck Driver (to and including 13 CY.); Flat Rack Material Truck Driver (to 5 tons); Fuel Service Truck Driver; Gang Truck Driver; Gravel Spreader; Greaseman, Tireman, Serviceman; Oil Distributor Driver (to & including 3,600 gal.); Power Broom Driver (street sweeper); Snow Plow Driver (the cy. rate of the truck); Transit Mix or Wet Mix Truck Driver; Utility Winch Truck Driver; Water Truck Driver (to & including 3,600 gal.)

Truck Drivers (Group 2).....$ 28.37 5.93
Dump Truck Driver (13 to 45 CY.); Flat Rack Material Truck Driver (over 5 tons); Low Boy & Tandem Axle Float Driver; Multiple Axle Type Truck (semi); Winch Trailer Truck Driver; Water Truck Driver (3,600 gal. & larger); Oil Distributor Driver (3,600 gal. & larger); Truck Mechanics

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive

Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were

adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION
"

"General Decision Number: WY20260041 01/02/2026

Superseded General Decision Number: WY20250041

State: Wyoming

Construction Type: Building

Counties: Wyoming Statewide.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Modification Number	Publication Date
0	01/02/2026

SAWY2025-001 05/01/2025

	Rates	Fringes
Asbestos Removal, Abatement and Demolition	$ 23.00	0.00
Blinds/Window-Covering Installer	$ 11.96	0.00
Boilermaker	$ 38.42	32.82
Bricklayers and Masons	$ 32.87	14.52
Carpenters and Joiners	$ 29.05	5.48
Carpet, Linoleum and Resilient Tile Layers	$ 40.00	0.00
Cement Masons/Plasterers	$ 28.00	4.20
Electricians	$ 35.17	14.33
Elevator Constructors	$ 56.57	41.83
Fire Sprinkler Installers	$ 35.69	9.36
Fire System Installers (non-water)	$ 31.77	7.05
General Laborers (Group 1)	$ 22.77	2.68

Axmen, hand faller; Bin wall installer; Bituminous curb builder; Burner (cutting torch); Car or truck loader; Concrete

saw; Concrete vibrator; Concrete worker; Creosote material handler; Dumpman; Erector/Installer (includes fences, guardrail, guideposts, etc.); Flagman; Form setter; Form stripper; General laborer; Hand operated vibrator roller; Jackhammer/pavement breaker; Landscaper; Material handler; Mechanical form cleaner; Mortarman; Nozzleman; Pipe setter; Pipe wrapper; Power saw operator; Power type concrete buggy; Pre-watering, pre-irrigation, and pre-wetting work; Riprap man, Rodman; Sandblaster & pot tender; Shoring & lagging open ditch; Signalmen; Scissorman or hopperman; Stake jumper; Tamper Operator; Tar & asphalt tender; Toolroom man; Wrecking & demolition crews; Unloading and packing

Glaziers	$ 24.62	4.64
Ironworker	$ 33.68	12.69
Limited Electricians (90 Volt or Less)	$ 32.62	6.43
Marble, Tile and Terrazzo Setters	$ 36.00	12.00
Mechanical, Heat and Frost Insulation	$ 25.50	2.63
Millwright Machinery Workers	$ 40.19	20.79
Operating Engineers (Group 1)	$ 30.68	7.61

A-frame truck; Air Compressor; Asphalt plant fireman/oiler; Auger machine (post hole digger); Brakeman; Broom operator; Bump grinder operator; Cableway signalman; Chip spreader operator; Concrete mixer (up to 1 yard); Concrete saw operator; Farm type tractor; Forklift operator; Form grader; Generator operator; Gunite and granite machine; Heater operator; Heavy duty repairman; Hopperman; Joint machine operator; Locomotive Fireman; Longitudinal float operator; Lubrication & Service engineer; Material hoist operator; Mechanical conveyor; Motorman; Oil distributor; Pavement breaker; Pump operator; Pumpcrete operator (up to 4 inches); Rodman/Rear chainman; Screed operator; Screening plant operator; Tamper & similar machines; Tire repairman; Tugger hoist; Underground freeze unit; Welding machine operator

Operating Engineers (Group 2)	$ 30.68	7.61

Asphalt plant operator; Backhoe operator; Cableway operator; CMI machine & similar operator; Compactor operator; Concrete batch plant operator; Crushing plant operator; Double drum hoist; Drilling machinery operator; Elevating grader; Front-end loader (up to 1.5 yards); Hydro-blast operator; Jumbo form

operator; Kolman type loader; Locomotive Engineer; Man lift elevator operator; Mixer operator (over 1 yard); Mucking machine operator; Paving machine operator; Pumpcrete operator (over 4 inches); Roller operator; Sub-grading machine operator; Tractor with power attachments; Trenching machine operator

Operating Engineers (Group 3)....$ 30.68 7.61
Dozer/pushcat; Dual drum mixer; Hydro crane (under 15 tons); Motor patrol-general; Scraper; Sideboom cat operator; Rigger; Pugmill equipment operator

Operating Engineers (Group 4)....$ 30.68 7.61
Finisher dozer operator; Hydro crane (15 to 30 tons); Loader operator (1.5 yards to 4 yards); Piledriver; Shovel, Dragline & Clamshell (2 yards)

Operating Engineers (Group 5)....$ 30.68 7.61
Carry lift operator; Cranes (under 25 tons); Grade-all; Instrument man; Loader operator (4 to 8 yards); Mole operator; Motor patrol-finisher; Pumpcrete-mobile crane or truck

Operating Engineers (Group 6)....$ 41.25 9.91
Cranes (25 to 50 tons); Four drum hoist; Heavy duty repairman, welder; Hydrocrane (30 to 50 tons); Loader operator (over 8 yards); Scraper operator, tandem

Operating Engineers (Group 7)....$ 41.25 9.91
Cranes (over 50 tons); Shovels, Draglines, & Clamshells (over 2 yards); Wheel excavator

Painters and Allied Trades.....$ 27.12 0.00

Plumbers and Pipefitters.....$ 36.94 9.49

Roofers.....$ 22.77 0.00

Semi-Skilled Laborers (Group 2).....$ 25.40 2.68
Asphalt raker & tamper; Brakeman and vibrator man; Gunite nozzleman; High Scalar; Mucker & bull gang laborer; Sandblaster nozzleman; Sewer pipe installer

Sheetmetal Workers.....$ 31.20 6.59

Sheetrock and Drywall Installers.....$ 29.76 5.16

Tenders (Group 4).....$ 25.40 3.99
Blaster/Powderman; Carpenter tender; Cement mason tender;

Chuck tender; Drill operators for blasting & grouting; Fork lift operator; Hod carriers; Nipper; Piling/caisson worker; Plasterer tender; Scaffold builder; Spaders; Terrazzo tenders; Tile setter tenders; Top man or top lander; Tuggers; Tunner & underground worker

Truck Drivers (Group 1).....$ 25.96 3.83
Cement truck (under 10 yards); Dump truck (under 13 cubic yards); Flat rack truck; Flex boom-single axle & twin screw; Forklift operator; Fuel/grease truck; Grease/service person; Lumber carrier; Material checker; Pickup truck driver; Truck driver distributor; Truck mechanic; Warehouse person; Water truck (single axle)

Truck Drivers (Group 2).....$ 29.64 9.22
Cardex person; Cement mixer (over 10 yards); Dump truck (over 13 cubic yards); Dumpster type equipment; Expeditor; Highboy, Lowboy, Floats, Semi-truck; Lead warehouse person; Scale person/checker/spotter; Snow plow; Tire repairman; Truck/diesel mechanic; Water truck (semi, tandem axle, Euclid); Winch Pole-A-Frame

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been

renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took

effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.

Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION
"

STANDARD SPECIFICATIONS

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

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requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

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recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

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33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

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43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

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1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

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F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

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into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

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ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

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inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

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B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

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established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

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D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

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B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

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and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

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Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

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3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

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or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

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of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

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conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

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Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

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Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

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L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

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4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

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Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

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6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

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B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

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2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

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3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

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H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

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7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

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7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

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I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

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3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

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document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

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d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

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9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

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D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

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E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

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B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

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9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

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ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

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E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

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ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

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B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

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1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

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11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

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Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

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and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

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2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

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consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

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g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

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Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

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thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

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D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

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losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

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or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

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establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

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4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work;

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

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b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

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submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

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significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

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d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

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appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

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attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

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provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

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18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC C-700, 2018 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions will have the meanings indicated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings indicated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

SC-1.01 Defined Terms

SC-1.01.A.8. Add the following language to the end of paragraph 1.01.A.8:

The Change Order form to be used on this Project is included in the Agreement Documents of the Project Manual.

SC-1.01.A.23. Add the following language to the end of paragraph 1.01.A.23:

The Field Order form to be used on this Project is included in the Agreement Documents of the Project Manual.

SC-1.01.A.42. Add the following language to the end of paragraph 1.01.A.42:

The Certificate of Substantial Completion form to be used on this Project is included in the Agreement Documents of the Project Manual.

SC-1.01.A.50. Add the following language to the end of paragraph 1.01.A.50:

The Work Change Directive form to be used on this Project is included in the Agreement Documents of the Project Manual.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

SC-2.01.A. Add the following language at the end of Paragraph 2.01.A:

> Required forms of the Performance Bond and Payment Bond are included in the Agreement Documents of the Project Manual.

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C. *Software Requirements for Electronic Document Exchange; Limitations*

1. Each party will acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the software formats required in this section of the EDP.

    a. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or adjust its transmission to comply with this EDP.

2. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.

2.03 *Before Starting Construction*

SC-2.03.A.3 Add the following language at the end of Paragraph 2.03.A.3:

The required schedule of values for the pump station shall be reviewed and approved by the engineer.

SC-2.06 Supplement Paragraph 2.06 of the General Conditions by adding the following paragraph:

D. *Requests by Contractor for Electronic Documents in Other Formats*

1. Release of any Electronic Document versions of the Project documents in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be at the sole discretion of the Owner.

2. To extent determined by Owner, in its sole discretion, to be prudent and necessary, release of Electronic Documents versions of Project documents and other Project information requested by Contractor ("Request") in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be subject to the provisions of the Owner's response to the Request, and to the following conditions to which Contractor agrees:

    a. The content included in the Electronic Documents created by Engineer and covered by the Request was prepared by Engineer as an internal working document for Engineer's purposes solely, and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, but not limited to any implied warranties of fitness for any purpose. As such, Contractor is advised and acknowledges that the content may not be suitable for Contractor's application, or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of

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accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.

b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Engineer to Contractor under the request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and the Contractor waives any claims against Engineer or Owner arising from use of data in Electronic Documents covered by the Request.

c. Contractor shall indemnify and hold harmless Owner and Engineer and their subconsultants from all claims, damages, losses, and expenses, including attorneys' fees and defense costs arising out of or resulting from Contractor's use, adaptation, or distribution of any Electronic Documents provided under the Request.

d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Engineer, unless such distribution is specifically identified in the Request and is limited to Contractor's subcontractors. Contractor warrants that subsequent use by Contractor's subcontractors complies with all terms of the Contract Documents and Owner's response to Request.

3. In the event that Owner elects to provide or directs the Engineer to provide to Contractor any Contractor-requested Electronic Document versions of Project information that is not explicitly identified in the Contract Documents as being available to Contractor, the Owner shall be reimbursed by Contractor on an hourly basis (at $**[200]** per hour) for any engineering costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Engineer.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.03 Reporting and Resolving Discrepancies

SC-3.03 Add the following new paragraph after Paragraph 3.03B.1.b.:

c. In resolving conflicts and discrepancies within the Contract Documents, the documents shall be given precedence in the following order: Agreement, Modifications, Addenda, General and Supplementary Conditions, Technical Specifications, and Drawings. Figure dimensions on Drawings shall govern over scaled dimension, and detailed Drawings shall govern over General Drawings. Any WORK that is reasonably inferred from the Specifications or Drawings as being required to produce the intended result shall be supplied whether or not it is specifically called for. WORK, materials, or equipment described in words which when so applied have a well-known technical or trade meaning shall be determined to refer to such recognized standards.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 Commencement of Contract Times; Notice to Proceed

SC-4.01.A. Delete paragraph 4.01.A in its entirety and insert the following in its place:

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A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within sixty (60) days after the Effective Date of the Agreement.

SC-4.05 Delay's in Contractor's Progress

Add the following sentence at the end of 4.05.A.:

The equitable adjustment in Contract Times shall be the amount of time recommended by the Engineer and approved by the Owner.

Amend Paragraph 4.05.C by adding the following subparagraphs:

5. *Weather-Related Delays*

a. If "abnormal weather conditions" as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled.

b. The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:

1) Every workday on which one or more of the following conditions exist will be considered a "bad weather day":

i) Total precipitation (as rain equivalent) occurring between 7:00 p.m. on the preceding day (regardless of whether such preceding day is a workday) through 7:00 p.m. on the workday in question equals or exceeds **[1/2-inch]** of precipitation (as rain equivalent, based on the snow/rain conversion indicated in the table entitled Foreseeable Bad Weather Days; such table is hereby incorporated in this SC-4.05.C by reference.

ii) Ambient outdoor air temperature at 11:00 a.m. is equal to or less than the following low temperature threshold: **[15˚]** degrees Fahrenheit; or, at 3:00 p.m. the ambient outdoor temperature is equal to or greater than the following high temperature threshold: **[105˚]** degrees Fahrenheit.

2) Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded by **[Southwest Wyoming Regional Airport]** weather monitoring station at **[Latitude 41.59417 N, Longitude 109.06528 West]**.

3) Contractor shall anticipate the number of foreseeable bad weather days per month indicated in the table in Exhibit B—Foreseeable Bad Weather Days.

4) In each month, every bad weather day exceeding the number of foreseeable bad weather days established in the table in Exhibit B—Foreseeable Bad Weather Days will be considered as "abnormal weather conditions." The existence of abnormal weather conditions will not relieve Contractor of the

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obligation to demonstrate and document that delays caused by abnormal weather are specific to the planned work activities or that such activities thus delayed were on Contractor's then-current Progress Schedule's critical path for the Project.

5) If a weather event (i.e., snowfall) creates conditions that prevent performance of planned work activities beyond the initial day of precipitation, subsequent days will be considered bad weather days provided that:

   (a) the conditions materially impede work on activities scheduled for those days, (b) the Contractor demonstrates that reasonable mitigation measures were taken, and
   (c) such activities were on the then-current Progress Schedule's critical path.

6) Contractor's entitlement to an adjustment of Contract Times for abnormal weather conditions under this paragraph shall be considered in conjunction with SC-16.05 (Winter Shutdown). If Contractor elects to implement a Winter Shutdown as permitted under SC-16.05, such period shall not be counted as weather-related delay days. Conversely, if Contractor does not implement a Winter Shutdown during the period between December 20 and March 1, Contractor must demonstrate compliance with SC-4.05.C requirements, including documentation of abnormal weather and its impact on critical path activities.

ARTICLE 5—SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.03 *Subsurface and Physical Conditions*

SC-5.03.A.1. Delete Paragraph 5.03.A.1 in its entirety and insert the following in its place:

5.03.A.1. those reports known to Owner of explorations and tests of subsurface conditions at the Site that contain Technical Data; and

SC-5.03.A.2. Delete Paragraph 5.03.A.2 in its entirety and insert the following in its place:

5.03.A.2. those drawings of existing physical conditions at or adjacent to the Site known to Owner, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

Add the following paragraph immediately after Paragraph 5.03.D.4.:

5.03.D.5. CONTRACTOR should not rely on "non-technical" data or related interpretations or opinions for bidding and construction purposes. Responsibility for the consequences of such reliance is expressly disclaimed by the OWNER and ENGINEER.

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SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Geotechnical Report WEGI	3-18-24	**Test holes**

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely: **[If there are no such drawings, so indicate in the table.]**

Drawings Title	Date of Drawings	Technical Data
None		**[Identify Technical Data]**

G. Contractor may examine copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents at **[Gr-RS-SC JPWB, 3 Telephone Canyon Road, Green River, Wyoming]** during regular business hours, or may request copies from Engineer.

5.06 *Hazardous Environmental Conditions at site*

SC-5.06 Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following:

A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to the Owner.

B. Not Used.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

SC-6.01. Add the following new paragraph immediately after paragraph 6.01.H:

I. The existence and amount of any bond required to be furnished by Contractor shall not limit or cap the amount of damages to which Owner is entitled in the event of breach or default by Contractor.

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.B:

1. The correction period specified as one year after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be two **[2]** years after Substantial Completion with the two years commencing on the date of Substantial Completion

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2. After Substantial Completion, Contractor shall furnish a warranty bond issued in the form of EJCDC® C-612, Warranty Bond (2018). The warranty bond must be in a bond amount of two million dollars. The warranty bond period will extend to a date two **[2]** years after Substantial Completion of the Work. Contractor shall deliver the fully executed warranty bond to Owner prior to or with the final application for payment.

3. The warranty bond must be issued by the same surety that issues the performance bond required under Paragraph 6.01.A of the General Conditions.

6.02 *Insurance—General Provisions*

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.H.2 of the General Conditions:

3. For the following Subcontractors, Suppliers, Utility Facilities or categories of Subcontractor or Supplier, Contractor shall require the following specified insurance, with policy limits as stated:

Facility	**Policy Limit**
WYDOT - Roadways	Per Encroachment Agreement
Kinder Morgan - Pipeline	Per Encroachment Agreement
Pacificorp – Jim Bridger Pipeline	Per Encroachment Agreement

4. Insurance requirements stated as 'Per Encroachment Agreement' shall be as set forth in the applicable Encroachment Agreement for each facility. Such agreements are attached hereto and made a part of these Supplementary Conditions by reference.

6.03 *Contractor's Insurance*

SC-6.03.A. Add the following new paragraph immediately after paragraph 6.03.C:

D. The policy limits for insurance required by paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. The City of Green River Wyoming, City of Rock Springs Wyoming, Sweetwater County Wyoming Joint Powers Water Board; the Wyoming Water Development Commission; Sunrise

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Engineering; and the officers, directors, members, partners, employees, agents, and consultants of each and any of them shall be included as additional insured under the General Liability Policy for this project.

2. Except for professional liability and pollution policies, all policies shall provide for the costs of defense outside of the policy limits, and thus any such defense shall not erode the policy limits.

E. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

F. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.
    b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
4. Underground, explosion, and collapse coverage.
5. Personal injury coverage.
6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

G. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

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1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
2. Any exclusion for water intrusion or water damage.
3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
4. Any exclusion of coverage relating to earth subsidence or movement.
5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
6. Any limitation or exclusion based on the nature of Contractor's work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

H. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	**Policy limits of not less than:**
General Aggregate	$ 2,000,000
Products—Completed Operations Aggregate	$10,000,000
Personal and Advertising Injury	$ 1,000,000
Bodily Injury and Property Damage—Each Occurrence	$ 2,000,000

I. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	**Policy limits of not less than:**
Bodily Injury	
Each Person	$ 1,000,000
Each Accident	$ 2,000,000
Property Damage	
Each Accident	$ 1,000,000
[or]	
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$ 3,000,000

J. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

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Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$10,000,000
General Aggregate	$10,000,000

K. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of $**[specify amount]** after accounting for partial attribution of its limits to underlying policies, as allowed above.

L. *Contractor's Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	$ 1,000,000
General Aggregate	$ 1,000,000

M. *Contractor's Professional Liability Insurance:* If Contractor will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	$ 1,000,000
Annual Aggregate	$ 1,000,000

N. *Railroad Protective Liability Insurance:* Prior to commencing any Work within 50 feet of railroad-owned and controlled property, Contractor shall (1) endorse its commercial general liability policy with ISO CG 24 17, removing the contractual liability exclusion for work within 50 feet of a railroad, (2) purchase and maintain railroad protective liability insurance meeting the following requirements, (3) furnish a copy of the endorsement to Owner, and (4) submit a copy of the railroad protective policy and other railroad-required documentation to the railroad, and notify Owner of such submittal.

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Railroad Protective Liability Insurance	Policy limits of not less than:
Each Claim	$ 2,000,000
Aggregate	$ 6,000,000

O. *Unmanned Aerial Vehicle Liability Insurance:* If Contractor uses unmanned aerial vehicles (UAV—commonly *referred* to as drones) at the Site or in support of any aspect of the Work, Contractor shall obtain UAV liability insurance in the amounts stated; name Owner, Engineer, and all individuals and entities identified in the Supplementary Conditions as additional insureds; and provide a certificate to Owner confirming Contractor's compliance with this requirement. Such insurance will provide coverage for property damage, bodily injury or death, and invasion of privacy.

Unmanned Aerial Vehicle Liability Insurance	Policy limits of not less than:
Each Claim	$ 1,000,000
General Aggregate	$ 1,000,000

P. *Other Required Insurance:* None

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Delete Paragraph 6.04.A and replace with the following:

SC-6.04.A. Contractor shall purchase and maintain property insurance on the work at the site in the amount of the full replacement cost thereof. Contractor shall be responsible for any deductible or self-insured retention. This insurance shall include the interests of Owner, Wyoming Water Development Commission, Contractor, Subcontractors, Engineer, and other officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee. Said policy shall be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightening, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and flood.

SC 6.04.B1.1 *Installation Floater*

1. Contractor shall provide and maintain installation floater insurance on a broad form or "all risk" policy providing coverage for materials, supplies, machinery, fixtures, and equipment that will be incorporated into the Work ("Covered Property"). Coverage under the Contractor's installation floater will include loss from covered "all risk" causes (perils) to Covered Property:

    a. of the Contractor, and Covered Property of others that is in Contractor's care, custody, and control;

    b. while in transit to the Site, including while at temporary storage sites;

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c. while at the Site awaiting and during installation, erection, and testing;

d. continuing at least until the installation or erection of the Covered Property is completed, and the Work into which it is incorporated is accepted by Owner.

2. The installation floater coverage cannot be contingent on an external cause or risk, or limited to property for which the Contractor is legally liable.

3. The installation floater coverage will be in an amount sufficient to protect Contractor's interest in the Covered Property. The Contractor will be solely responsible for any deductible carried under this coverage.

4. This policy will include a waiver of subrogation applicable to Owner, Contractor, Engineer, all Subcontractors, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them.

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. *Builder's Risk Requirements:* The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.

b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.

2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

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3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).

4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier). If this coverage is subject to a sublimit, such sublimit will be a minimum value of stored material.

5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of value of transported material.

6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.

7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.

8. include performance/hot testing and start-up, if applicable.

9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.

10 include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:

    a. **Green River-Rock Springs-Sweetwater County Joint Powers Water Board, City of Rock Springs, Sunrise Engineering**

Add Paragraph 6.04.F after 6.04E:

SC-6.04

F. Contractor shall purchase and maintain equipment breakdown insurance which will include interests of Owner, Contractor, Subcontractors, and Engineer, Wyoming Water Development Commission, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provision:

G. *Coverage for Completion Delays:* The builder's risk policy will include, for the benefit of Owner, loss of revenue and soft cost coverage for losses arising from delays in completion that result from covered physical losses or damage. Such coverage will include, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, compensation for loss of net revenues, rental costs, and attorneys' fees and engineering or other consultants' fees, if not otherwise covered.

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SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

H. *Builder's Risk and Other Property Insurance Deductibles:* The purchaser of any required builder's risk, installation floater, or other property insurance will be responsible for costs not covered because of the application of a policy deductible.

1. The builder's risk policy (or if applicable the installation floater) will be subject to a deductible amount of no more than $**[number]** for direct physical loss in any one occurrence.

SC-6.05 Property Losses; Subrogation

Delete 6.05.A. and replace with the following:

SC-6.05.A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 6.04 will protect Owner, Contractor, Subcontractors, Wyoming Water Development Commission, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them) in such policies and will provide primary noncontributory coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any loss fully covered by such policies. None of the above waivers shall extend to the rights that the party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

Delete Paragraph 6.05.B. in its entirety.

Delete Paragraph 6.05.C. in its entirety.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.03 *Labor; Working Hours*

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be **[7:00 am – 7:00 pm Monday through Friday]**.

2. Owner's legal holidays are **[All Federal Holidays]**.

SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state "…all Work at the Site must be performed during regular working hours, **[Monday]** through **[Friday]**. Contractor will not perform Work on a **[Saturday]**, **[Sunday]**, or any legal holiday."

SC-7.03.A. Add the following language at the end of Paragraph 7.03.A:

If during the performance of the Work, the Owner determines that the Contractor has provided incompetent, unsuitably- qualified personnel, the Owner shall notify the Contractor

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in writing and the Contractor shall replace said personnel within seven (7) days with competent, suitably-qualified personnel.

SC-7.03 Add the following new paragraph immediately after Paragraph 7.03.C:

D. **[Contractor]** shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer's services (including those of the Resident Project Representative, if any), Owner's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-7.03 Add the following new subparagraph immediately after Paragraph SC-7.03.D:

1. For purposes of administering the foregoing requirement, additional overtime costs are defined as **[Work requiring presence of construction observer on weekends or holidays as determined by Engineer or Owner]**.

SC-7.07 Concerning Subcontractors and Suppliers

Add the following immediately after Paragraph 7.07.M:

SC7.07.N. If required within the Instructions to Bidders, identification of Subcontractors, Suppliers or other entities shall be submitted as an Attachment to the Bid.

7.09 *Permits*

SC 7.09 Add the following to section 7.9.

Prosecution of work will require that the contractor secure outside observers for the following tasks:

- Pre Construction Migratory Bird Survey per March 26, 2025 review letter from the WG&F.
- Archaeological and Paleontological Construction Observation (Follow BLM guidelines)
- Observation of trenching across Old Lincoln Highway Sta. 10+00 to Sta. 11+00. (Contact BLM if items are observed in trench or spoils.)

The following facility crossings will require advance notice to the company such that work can be observed by a company representative. The Contractor shall provide notice to the company but shall not be required to pay for the observation. The Contractor shall also meet insurance requirements outlined in the encroachment permits or otherwise required by the facility owner.

- Crossing of Kinder Morgan facilities to be observed by Kinder Morgan Representative
- Crossing of Pacificorp's Jim Bridger pipeline to be observed by representative of Pacificorp.
- Crossing of Rocky Mountain Power to be observed by representative of Rocky Mountain Power.

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For each facility crossing and observation requirement listed herein, the Contractor shall comply with all notice requirements set forth in the applicable encroachment permits and related agreements. Such permits and agreements are attached hereto and made a part of these Supplementary Conditions by reference. Advance notice shall be provided in accordance with the timelines and procedures specified in those documents.

7.10 *Taxes*

SC-7.10 Add a new paragraph immediately after Paragraph 7.10.A:

B. Owner is not exempt from payment of sales and compensating use taxes of the State of **Wyoming** and of cities and counties thereof on all materials to be incorporated into the Work. Contractor must pay sales tax on all materials and equipment used in the work. For purposes of payment of sales tax, CONTRACTOR shall designate Sweetwater County, Wyoming as the location of purchases and delivery of all goods, materials, supplies and equipment for this project.

SC-7.11 Laws and Regulations

SC 7.11.A. Add the following language at the end of Paragraph 7.11.A:

Among the notices Contractor shall provide is the posting on the construction site that is required by Wyoming Statute 16-6-121(f).

Add the following new Paragraph after 7.11.C:

7.11.D. Each and every provision of law and clause required by law to be inserted in the Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein, and if through mistake or otherwise, any such provision is not inserted, or is not correctly inserted, then upon application of either party, the Contract shall forthwith be physically amended in writing to make such insertion or correction.

Contractor shall comply with all Wyoming Statutes dealing with public works projects, including but not limited to: W.S. 16-6-101 through -121, 16-6-201 through -206, 16-6-701 through -708, 16-6-1001, and 15-1-113. Contractor shall also comply with all applicable federal laws and regulations.

Contractor shall, before commencing work on the Project, furnish the OWNER's attorney proof of compliance with the following:

1. Wyoming Statute 16-6-121(f), which requires Contractor to post on the construction site a prominent sign citing Wyoming Statute 16-6-121(f) and stating that any subcontractor or materialmen shall give notice to the general contractor of a right to protection under the bond or guarantee and that failure to provide the notice shall waive the subcontractor or materialmen's protection under the bond or guarantee.
2. Wyoming Worker's Compensation Act.
3. Wage Payment Bond, Wyo. Stat. 27-1-106 (2025 Edition).
4. Wyoming Preference Act of 1971. (Wyo. Stat. 16-6-201 through 16-6-206).

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SC-7.16 Submittals

Delete Paragraph 7.16.B.1.a. and replace with the following:

7.16.B.1.a.: Contractor shall submit the following number of copies of Shop Drawings: _3_.

Delete Paragraph 7.16.B.2.a. and replace with the following:

7.16.B.2.a.: Contractor shall submit the following number of Samples: _1__.

SC-7.18 Indemnification

SC-7.18.A. Amend the third line to read: "…harmless Owner, Engineer, Wyoming Water Development Commission, and the officers, directors, members, partners, employees, agents…".

SC-7.18.B. Amend the first line to read: "In any and all claims against Owner, Engineer or Wyoming Water Development Commission and any of their officers, directors, members…".

Amend the eighth line to read: "…Subcontractor, supplier, insurance company or other individual or entity under workers' compensation acts, disability benefit acts, other employee benefit acts, or applicable insurance policies".

ARTICLE 8—OTHER WORK AT THE SITE

Delete Paragraph 8.02.A in its entirety and replace with the following:

SC 8.02.A. Owner intends to contract with others for the performance of other work on the Project at the Site.

1. Owner shall have the authority and responsibility for coordination of others operating under separate contracts at the Site:

2. The following specific matters are to be covered by such authority and responsibility: 1)Coordination of the work of Automation Instrumentation Controls, which is the Project System SCADA and Control Contractor, 2) Coordination of the work of Questar Gas, which is to extend natural gas line, 3) Coordination of the work of Rocky Mountain Power Company, which is to extend the existing electrical distribution system,

3. The extent of such authority and responsibility is: Scheduling of Work with the above stated entities, so as to effectively combine efforts with that of the Contractor in a timely and coordinated fashion to the greatest degree possible. The Contractor is expected to reasonably assist and cooperate in the coordination of work under his control.

SC-8.03 Legal Relationships

SC 8.03.C. Replace GC 8.03.C. with the following:

SC 8.03.C.

1. Should Contractor cause damage to the work or property of any other contractor at the Site, or should any claim arising out of Contractor's performance of the Work at the Site be

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made by any other contractor against Contractor, Owner, Engineer, or the construction coordinator, then Contractor (without involving Owner, Engineer, or construction coordinator) shall either (1) remedy the damage, (2) agree to compensate the other contractor for remedy of the damage, or (3) remedy the damage and attempt to settle with such other contractor by agreement, or otherwise resolve the dispute by arbitration or at law.

2. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, the construction coordinator and the officers, directors, partners, employees, agents and other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any other contractor against Owner, Engineer, consultants, or the construction coordinator to the extent said claim is based on or arises out of Contractor's performance of the Work. Should another contractor cause damage to the Work or property of Contractor or should the performance of work by any other contractor at the Site give rise to any other Claim, Contractor shall not institute any action, legal or equitable, against Owner, Engineer, or the construction coordinator or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from Owner, Engineer, or the construction coordinator on account of any such damage or Claim.

3. If Contractor is delayed at any time in performing or furnishing the Work by any act or neglect of another contractor, and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a Claim for an extension of times in accordance with Article 4.05. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to Owner, Engineer, and construction coordinator for any delay, disruption, interference, or hindrance caused by any other contractor. This paragraph does not prevent recovery from Owner, Engineer, or construction coordinator for activities that are their respective responsibilities.

ARTICLE 10 - ENGINEER'S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

SC-10.03 Resident Project Representative

Replace 10.03.A and 10.03.B. in their entirety with the following paragraphs:

10.03.A. The Resident Project Representative (RPR) will be Engineer's employee or agent at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions. RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall be through or with the full knowledge and approval of Contractor. The RPR shall:

1. *Schedules:* Review the progress schedule, schedule of Shop Drawing and Sample submittals, and schedule of values prepared by Contractor and consult with Engineer concerning acceptability.

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2. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences and other project-related meetings, and prepare and circulate copies of minutes thereof.

3. *Liaison*:

a. Serve as Engineer's liaison with Contractor, working principally through Contractor's authorized representative, assist in providing information regarding the intent of the Contract Documents.

b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

4. Interpretation of Contract Documents*:* Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

5. *Shop Drawings and Samples:*

a. Record date of receipt of Samples and approved Shop Drawings.

b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

6. *Modifications:* Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.

7. *Review of Work and Rejection of Defective Work*:

a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.

b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress will not produce a completed Project that conforms generally to the Contract Documents or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

8. *Inspections, Tests, and System Startups:*

a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.

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b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.

c. Observe Contractor conducted compaction testing, weld testing and concrete sampling. Conduct random compaction correlation testing with an independent tester as agreed to with the Owner.

9. *Records:*

a. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.

b. Maintain records for use in preparing Project documentation.

10. *Reports:*

a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the progress schedule and schedule of Shop Drawing and Sample submittals.

b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.

c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, damage to property by fire or other causes, or the discovery of any Hazardous Environmental Condition.

11. *Payment Requests:* Review Applications for Payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the schedule of values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

12. *Certificates, Operation and Maintenance Manuals:* During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Specifications to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

13. *Completion*:

a. Participate in a Substantial Completion inspection, assist in the determination of Substantial Completion and the preparation of lists of items to be completed or corrected.

b. Participate in a final inspection in the company of Engineer, Owner, and Contractor and prepare a final list of items to be completed and deficiencies to be remedied.

c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the Notice of Acceptability of the Work.

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10.03.B. Add the following new paragraphs immediately after Paragraph 10.03.B:

The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, Suppliers, or Contractor's superintendent.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work unless such advice or directions are specifically required by the Contract Documents.

5. Advise on, issue directions regarding, or assume control over safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.

8. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 12—CLAIMS

Add the following new Paragraph immediately after Paragraph 12.01.G:

12.01.E. Owner retains complete governmental immunity and full protection from any and all claims hereunder.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

SC 13.01.B.c. Delete Paragraph 13.01.B.c in its entirety and insert the following in its place:

c. Construction Equipment and Rental:

1) Rentals of all non-Contractor owned construction equipment and machinery, and the parts thereof in accordance with rental agreements approved in advance by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor will be paid at the rate shown for such equipment in the Owner-approved hourly rate sheet submitted with the Bid. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), costs will include the time the equipment or machinery is in use on the changed Work. The costs of transportation, loading,

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unloading, assembly, dismantling, and removal when directly attributable to the changed Work will not apply to equipment already onsite which is available for other portions of the Work. The cost of any such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than $1,000 will be considered small tools.

13.03 *Unit Price Work*

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert replace it with the following:

13.03.E. In the event of an increase or decrease in the bid quantity of major pay items of unit price contract, the adjustments in unit prices will be governed as follows:

1. If the quantity of any major pay item of Work required to complete the project varies from the original contract quantity by 25 percent or less, payment will be made at the contract unit price.

2. Should the original contract quantity of any major pay item of Work be increased or decreased by more than 25 percent, either party to the Agreement may demand in writing within fifteen days that a Change Order be negotiated with an adjustment of contract unit prices satisfactory to both parties.

3. Where the original contract quantity of a major pay item is increased, the adjustment contract price will apply only to the portion of the pay item which is in excess of 125 percent of the original quantity and will be negotiated on the basis of the actual cost of the entire item, complete, in place, plus a negotiated allowance for profit and applicable overhead costs.

4. In the case where a major pay item is decreased by more than 25 percent from the original contract quantity, the adjusted contract unit price will apply to the quantity measured and accepted for payment. At the request of the Contractor, adjustment in the contract unit price for the quantity of a pay item which is less than 75 percent of the original contract quantity will be considered, insofar as it justifies an increase in the pro rate share of the fixed expense chargeable to such pay item because of the decreased quantity of the item.

5. If neither party demands in writing an adjustment of unit prices for major pay items of Work, within fifteen days of proposed quantity adjustment, then the contract unit prices will govern.

6. No contract unit price adjustment as provided herein will be made for any major pay item of Work for which the total amount of the adjustment is less than $10,000.00.

Add the following Section immediately after Section 13.03.E which is to read as follows:

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13.03.E. For the purpose of this Supplementary Condition, major pay items are defined as any contract pay item having an original amount bid in excess of 5 percent of the total original Contract Price.

ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 *Progress Payments*

15.01.B.3. Add the following sentence to 15.01.B.3: Each application shall also include an "Affidavit of Payment to Materialmen, Subcontractors and Laborers."

15.01.D.1. Delete Paragraph 15.01.D.1. in its entirety and replace it with the following:

15.01.D.1. Forty-five days after the presentation of the Application for Payment to the Owner with Engineer's recommendation, the amount recommended will (subject to any owner set-offs) become due and when due will be paid by Owner to Contractor.

SC-15.01 Add the following new Paragraph 15.01.F:

F. OWNER reserves the right, in its sole determination, to require lien waivers from the CONTRACTOR and/or any or all subcontractors and/or materialmen for work completed to date prior to making a progress payment and shall have the right to withhold all or any portion of a progress payment if lien waivers are required in connection with the progress payment but are not provided by CONTRACTOR.

15.03 *Substantial Completion*

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

SC-15.06 Final Payment Becomes Due

SC-15.06.E. Delete paragraph 15.06.E. of the General Conditions in its entirety and insert the following in its place:

15.06.E. "The OWNER shall not be required to make final payment to the CONTRACTOR until such time as the provisions of Wyoming Statute Section 15-1-113 (h), 16-6-116, and 16-6-117, have been fulfilled. If no claims or liens have been filed within a forty-one (41) day period following the first notice that the project is complete and ready for final payment, the retainage percentage will be paid (final estimate) within twenty (20) days after the expiration of said 41-day advertisement period. Should any liens or claims be filed, retainage equal to the amount of the lien or claim will be held until satisfactory agreement is reached between the OWNER, CONTRACTOR, and CONTRACTOR'S surety. All warranties and guarantees from the CONTRACTOR, subcontractors, suppliers, manufacturers, etc., shall be delivered to the

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OWNER and be of acceptable form and content as determined by the OWNER before final payment is made."

15.08 *Correction Period*

15.08.E. add the following to the end of the sentence: or will be extended until expiration of two years from date of Substantial Completion, whichever is later.

SC-15.08 Add the following new Paragraph 15.08.G:

G. The correction period specified as two years after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be the number of years set forth in SC-6.01.B.1; or if no such revision has been made in SC-6.01.B, then the correction period is hereby specified to be two years after Substantial Completion.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.02 Owner May Terminate For Cause

Delete Paragraph 16.02.A.3 in its entirety and insert the following in its place:

SC-16.02.A.3. "CONTRACTOR'S disregard of Laws and Regulations or Permit provisions of any public body having jurisdiction".

SC -16.05 add the following paragraph 16.05

SC-C16.05 *Winter Shutdown*

C. The Contractor may terminate pipeline or building construction operations between December 20th and March 1st due to inclement weather conditions that are not conducive to production and or quality of work. Such shutdown shall be complete with no on-going work. This shutdown time will not count against the calendar days of the contract. Should work occur during the shutdown requiring the periodic presence or observation of the Engineer, Resident Project Representative, JPWB or City, the contractor shall reimburse the JPWB for the cost of said presence or observation.

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EXHIBIT A—SOFTWARE REQUIREMENTS FOR ELECTRONIC DOCUMENT EXCHANGE

Item	Electronic Documents	Transmittal Means	Data Format	Note (1)
a.1	General communications, transmittal covers, meeting notices and responses to general information requests for which there is no specific prescribed form.	Email	Email	
a.2	Meeting agendas, meeting minutes, RFI's and responses to RFI's, and Contract forms.	Email w/ Attachment	PDF	(2)
a.3	Contactors Submittals (Shop Drawings, "or equal" requests, substitution requests, documentation accompanying Sample submittals and other submittals) to Owner and Engineer, and Owner's and Engineer's responses to Contractor's Submittals, Shop Drawings, correspondence, and Applications for Payment.	Email w/ Attachment	PDF	
a.4	Correspondence; milestone and final version Submittals of reports, layouts, Drawings, maps, calculations and spreadsheets, Specifications, Drawings and other Submittals from Contractor to Owner or Engineer and for responses from Engineer and Owner to Contractor regarding Submittals.	Email w/ Attachment or LFE	PDF	
a.5	Layouts and drawings to be submitted to Owner for future use and modification.	Email w/ Attachment or LFE	DWG	
a.6	Correspondence, reports and Specifications to be submitted to Owner for future word processing use and modification.	Email w/ Attachment or LFE	DOC	
a.7	Spreadsheets and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	EXC	
a.8	Database files and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	DB	

Notes	
(1)	All exchanges and uses of transmitted data are subject to the appropriate provisions of Contract Documents.
(2)	Transmittal of written notices is governed by Paragraph 18.01 of the General Conditions.

Key	
Email	Standard Email formats (.htm, .rtf, or .txt). Do not use stationery formatting or other features that impair legibility of content on screen or in printed copies
LFE	Agreed upon Large File Exchange method (FTP, CD, DVD, hard drive)
PDF	Portable Document Format readable by Adobe® Acrobat Reader Version **PDF Exchange**
DWG	Autodesk® AutoCAD .dwg format Version **2026**
DOC	Microsoft® Word .docx format Version **Office 2021**
EXC	Microsoft® Excel .xls or .xml format Version **Office 2021**
DB	Microsoft® Access .mdb format Version **Acess 2021 or 365 Access**

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EXHIBIT B—FORESEEABLE BAD WEATHER DAYS

Month	Number of Foreseeable Bad Weather Days in Month Based on Precipitation as Rain Equivalent (inches) (1)	Ambient Outdoor Air Temperature (degrees F)	
		Number of Foreseeable Bad Weather Days in Month Based on Low Temperature (at 11:00 a.m.)	Number of Foreseeable Bad Weather Days in Month Based on High Temperature (at 3:00 p.m.)
January	0	8	0
February	0	8	0
March	1	6	0
April	1	3	0
May	3	0	0
June	2	0	0
July	1	0	1
August	1	0	1
September	1	0	1
October	3	1	0
November	0	5	0
December	0	7	0

Notes:

1. Two inches of sleet equal one inch of rain. Five inches of wet, heavy snow equal one inch of rain. Fifteen inches of “dry” powder snow equals one inch of rain.
2. In any given month precipitation and temperature days may be additive if they occur on different days.

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EXHIBIT C—GEOTECHNICAL BASELINE REPORT SUPPLEMENT TO THE SUPPLEMENTARY CONDITIONS

1.01 Definitions

SC-1.01 Add to the list of definitions in Paragraph 1.01.A by inserting the following as numbered items in their proper alphabetical positions:

1. *Geotechnical Baseline Report (GBR)*—The interpretive report prepared by or for Owner regarding subsurface conditions at the Site, and containing specific baseline geotechnical conditions that may be anticipated or relied upon for bidding and contract administration purposes, subject to the controlling provisions of the Contract, including the GBR's own terms. The GBR is a Contract Document.

2. *Geotechnical Data Report (GDR)*—The factual report that collects and presents data regarding actual subsurface conditions at or adjacent to the Site, including Technical Data and other geotechnical data, prepared by or for Owner in support of the Geotechnical Baseline Report. The GDR's content may include logs of borings, trenches, and other site investigations, recorded measurements of subsurface water levels, the results of field and laboratory testing, and descriptions of the investigative and testing programs. The GDR does not include an interpretation of the data. If opinions, or interpretive or speculative non-factual comments or statements appear in a document that is labeled a GDR, such opinions, comments, or statements are not operative parts of the GDR and do not have contractual standing. Subject to that exception, the GDR is a Contract Document.

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following to Paragraph 5.03 A:

A. *Reports and Drawings:* The Supplementary Conditions hereby identify:

4. The report of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data is as follows:

a. *Report Title:* **[Geotechnical Investigation Report – Western EGI]**

b. *Date of Report:* **[03-18-24]**

c. *Technical Data in report upon which Contractor may rely*: **[Bore logs]**

5. The general soil types shown on the plan were obtained from the USDA soil survey. These soil types may or may not reach the extents and depths listed by the USDA and are provided for general understanding. The USDA web-based soil survey may have additional information.

6. Contractor may examine copies of reports and drawings identified immediately above that were not included with the Bidding Documents at **City Hall, 212 D Street Rock Springs, Wyoming** during regular business hours, or may request copies from Engineer, at the cost of reproduction.

SC 5.03 Replace the following sections of 5.03:

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B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph SC-5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents:* Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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DIVISION 1

GENERAL REQUIREMENTS

SUNRISE
ENGINEERING

01019.1 DESCRIPTION

This Section covers measurement and payment practices utilized by Sunrise Engineering in performing its contract management services according to the requirements of these Specifications and other parts of the Contract Documents.

01019.2 MEASUREMENT

01019.2.1 METHODS

The method of measurement and computations to be used in determination of quantities of material furnished, and of work performed under the Contract, will be those methods generally recognized as conforming to good engineering practice.

When items of improvement, equipment, or service referred to herein as "work" are shown on the plans and/or called for in the specifications for the CONTRACTOR to furnish, install, or provide, the items of work shall be measured and paid for in one of two ways. First, if the item of work is considered incidental to other items in the Bid Schedule, no separate measurement and payment shall be made and no separate bid item in the bid schedule will appear. In this case measurement and payment for this work shall be included by the CONTRACTOR in other bid items on the bid schedule. Second, when shown separately on the bid schedule, the item of work shall be measured as called for in the specifications and paid for at the contract unit price for that work.

01019.2.2 ACCURATE PRICING

The Bidder shall include a price for all bid items in the Bid Schedule and the Schedule of Values if required. Failure to do so may render the Bid non-responsive and may cause its rejection. All bids will be checked for errors. In the event the total "amount" indicated on the Bid schedule for a bid item does not equal the product of the unit price times the estimated quantity, the unit price shall govern, and the amount will be corrected accordingly. In the event the Bid Total does not agree with the sum of the prices bid on the individual bid items, the individual item prices shall govern and the total for the Bid schedule will be corrected accordingly. The CONTRACTOR shall be bound by any such corrections. For "Lump Sum" bid items, where applicable, the total shown on the Schedule of Values shall equal the amount entered for the corresponding bid item on the Bid schedule.

01019.2.3 U.S. STANDARD MEASURE

All work completed under this Contract will be measured by U.S. standard measure for the units described herein. Work performed by the CONTRACTOR will be measured in those units in accordance with the procedure described herein.

01019.2.4 MEASUREMENT BY ENGINEER

Since the quantities appearing on the Bid Schedules are approximate only and are prepared for the comparison of bids, all work and materials are subject to measurement by the ENGINEER. Measurement of work performed by the CONTRACTOR on Bid items with unit prices other than "lump sum" will be for the actual quantities of work performed and accepted, or material furnished in accordance with the Contract. In the case of lump sum bid items, the ENGINEER will verify that all of the work represented by the bid item has been completed.

01019.2.5 VARIATIONS IN QUANTITIES OF WORK

The scheduled quantities of work to be done and materials to be furnished may each be increased, decreased, or omitted at the OWNER's discretion.

01019.2.6 MEASUREMENT BY LUMP SUM

The term "Lump Sum" when used as a unit of measurement for a specific improvement or separate component of a unit shall include all work necessary to complete that entire unit, including all necessary fittings and accessories delineated by the pay limits as shown on the Drawings. If no pay limits are shown on the Drawings, then the improvement shall include all fittings and accessories within 5-feet of the item.

01019.2.7 MEASUREMENT BY LINEAL FOOT

All work measured by the lineal foot shall be measured parallel to the centerline. For water and gas piping, no deduction will be made for valve, fittings or carrier pipe. For sewer collection piping, measurement shall be to the inside surface of connecting manholes. Piping connected to structures, except headwalls, shall be measured to a point five (5) feet outside of that structure, unless indicated otherwise on the Drawings.

A station, when used as a unit of measurement, will be 100 lineal feet.

Items measured by the lineal foot; such as pipe culverts, guardrail, under-drains, etc., will be measured parallel to the base or foundations upon which structures are placed.

The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fractions of inches.

01019.2.8 MEASUREMENT BY AREA

Area computations will be made from actual horizontal and transverse measurements made on the site of the work.

Structures will be measured to the neat lines shown on the plans or as altered to fit site conditions.

Lumber will be measured by the thousand feet board measure (M.F.B.M.) actually incorporated in the structure. Measurement will be based on nominal widths and thickness and the extreme length of each piece.

01019.2.9 MEASUREMENT BY VOLUME

In computing volumes of excavation, the average end area method will be used unless the ENGINEER and CONTRACTOR agree, in writing, to an alternate method.

Materials to be measured by volume or by load count shall be hauled in approved vehicles and measured at the point of delivery. Vehicles for this purpose may be of any size or type, provided the body is shaped so the actual volume may be readily and accurately determined.

When liquid bituminous materials are measured by the gallon or ton, volumes will be measured at 60° F, or will be corrected to the volume of 60 degrees F, using ASTM D 1250 for asphalt or ASTM D 633 for tars. When bituminous materials are shipped by truck or transport, net certified weights or volume subject to correction for loss or foaming, may be used for computing quantities.

01019.2.10 MEASUREMENT BY WEIGHT

The term "ton" will mean the short ton of 2,000 pounds avoirdupois.

When measurement units require weighing materials for payment, the CONTRACTOR shall be responsible for providing weight measurement from commercial certified scales or from scales provided at the job site which are certified in the state wherein the work is located.

Cement will be measured by the ton or hundredweight.

01019.2.11 CONVERSION OF WEIGHT TO VOLUME

When requested by the CONTRACTOR and approved by the ENGINEER in writing, materials specified to be measured by the cubic yard may first be weighed and the weight converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the ENGINEER and agreed to by the CONTRACTOR before this method of measurement of quantities is used.

01019.2.12 SPECIFIC MANUFACTURED ITEMS

When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit, weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerance in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

01019.2.13 RENTAL EQUIPMENT

Rental of equipment will be measured in hours of actual working time and necessary traveling time of the equipment within the limits of the project. If equipment is ordered held on the project on a standby basis by the ENGINEER, the agreed rental rate, minus the labor and fuel costs, will be paid.

01019.2.14 MEASUREMENT BY EACH

All work measured by each shall be an individual or single unit.

01019.3 PAYMENT

01019.3.1 SCOPE OF PAYMENT

The CONTRACTOR shall receive and accept compensation provided in the Contract as full payment for:

- Furnishing all materials, labor, equipment, tools, transportation and incidentals required for completion of work.
- All loss or damage due to the nature of the work, action of the elements and unforeseen difficulties until final acceptance by the ENGINEER, subject to the provisions of the General Conditions.
- All costs arising from any infringement of a patent, trademark or copyright.
- Bids shall include all sales tax and all other applicable fees.

01019.3.2 NON-PAYMENT

No payment will be made for:

- Work which is in excess of that described in the Contract Documents.

- Removal and replacement of defective work.
- Loss of anticipated profits.

01019.3.3 LUMP SUM

The term "lump sum", when used as a unit for payment, shall include all work required to complete the item, including all necessary fittings and accessories, as described in the Bid Schedule.

01019.3.4 FULL PAYMENT

The CONTRACTOR shall receive and accept compensation provided for in the Contract as full payment for furnishing all materials and for performing all work under the Contract in a complete and acceptable manner and for all risk, loss, damage or expense of whatever character arising out of the nature of the work or the execution thereof.

01019.3.5 VARIATION IN QUANTITY OF WORK

The OWNER reserves the right to make variations in quantities by adding to, or deleting from, quantities listed in the bid schedule in order to match the total bid with the money available in the budget.

01030.1 DESCRIPTION

This section covers project meetings including the pre-construction meeting and other progress and/or work coordination meetings conducted to provide communication and awareness to all parties associated with the Contract.

01030.2 PRE-CONSTRUCTION CONFERENCE

Prior to the commencement of work at the site, a pre-construction conference will be held at a mutually agreed time and place to be arranged by the ENGINEER. The ENGINEER shall also provide notification to all parties expected to attend the meeting. Attendees will include the following:

- ENGINEER
- Project Inspector
- OWNER/OWNER's Representative
- CONTRACTOR/CONTRACTOR's Representative/ Subcontractors as appropriate
- Governmental Representatives as appropriate (State, County, Municipal, etc.)
- Manufacturer/Supplier Representatives/Adjoining CONTRACTORs, as appropriate.
- Utility Service Representatives as appropriate.

01030.2.1 Unless previously submitted to the ENGINEER, the CONTRACTOR shall bring to the conference one copy each of the following:

- Contract construction schedule in accordance with the General Conditions.
- Procurement schedule of major equipment and materials and items requiring long lead-time.
- Shop Drawings, samples or substitution proposals for items proposed as substitutions or "or equal" items.
- Schedule of work that includes the anticipated monthly payment amounts during the contract.
- A Schedule of Values of work to be paid for as lump sum items where partial payment is anticipated.

01030.2.2 The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda may include but not be limited to the following items:

- CONTRACTOR's Work Schedule.
- Transmittal, review, distribution and approval of CONTRACTOR's submittals.
- Processing of applications for payment.
- Maintaining records and documents.
- Critical work sequencing.
- Field decisions and Change Orders.
- Use of project site, office and storage areas, security, housekeeping, and OWNER's needs.
- Major equipment deliveries and priorities.
- Interpretation of Drawings and Specifications.
- CONTRACTOR's responsibilities for safety, first-aid and sanitation.

01030.2.3 The ENGINEER will preside at the pre-construction conference and will arrange for keeping minutes and distributing them to all attendees to the meeting.

01030.3 PROGRESS/COORDINATION MEETINGS

01030.3.1 The CONTRACTOR shall conduct regular on-site progress and coordination meetings at least weekly and at other times as requested by ENGINEER or as required by progress of the work. The CONTRACTOR, ENGINEER, and all Subcontractors active on the site shall be represented at each meeting. The CONTRACTOR may, at its discretion, request attendance by representatives of its suppliers, manufacturers, and other Subcontractors. The CONTRACTOR shall be responsible for providing written notification to those deemed necessary for attendance at least 36 hours prior to the time set for the meeting.

01030.3.2 The CONTRACTOR shall preside at the meetings and maintain a file of minutes of the proceedings. The purpose of the meetings will be to review the progress of the work, maintain coordination of effort, discuss changes in scheduling, and resolve other problems which may develop.

01090.1 DESCRIPTION

Wherever in these Specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronyms or abbreviations only. As a guide to the user of these Specifications, the following acronyms or abbreviations, which may appear herein, shall have the meanings indicated below.

01090.1.1 DEFINITIONS OF ABBREVIATIONS AND ACRONYMS

AAR	Association of American Railroads
AASHTO	American Association of the State Highway and Transportation Officials
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGA	American Gas Association
AGC	Associated General Contractors
AGMA	American Gear Manufacturers Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute, Inc.
APWA	American Public Works Association
ARI	Air Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASQC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BLM	Bureau of Land Management (U.S. Department of Interior)
CDA	Copper Development Association
CEMA	Conveyor Equipment Manufacturer's Association
CGA	Compressed Gas Association
CFR	Code of Federal Regulations
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CS	Commercial Standard of NBS (U.S. Dept. of Commerce)
CTI	Cooling Tower Institute
DIP	Ductile Iron Pipe
EIA	Electronic Industries Association
EPA	U. S. Environmental Protection Agency
ETL	Electrical Test Laboratories
FEMA	Federal Emergency Management Administration
FERC	Federal Energy Regulatory Commission
FS	Forest Service (U.S. Department of Agriculture)
FWS	Fish and Wildlife Service
GI	Galvanized Iron

IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
ID	Inside Diameter
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IMC	International Mechanical Code
IME	Institute of Makers of Explosives
IPC	International Plumbing Code
ISA	Instrument Society of America
ISO	International Organization for Standardization
MBMA	Metal Building Manufacturer's Association
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFGC	National Fuel Gas Code
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NRCS	Natural Resources Conservation Service (U.S. Department of Agriculture) (formerly SCS)
NSF	National Sanitation Foundation
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PDI	Plumbing and Drainage Institute
PE	Polyethylene
PVC	Polyvinyl Chloride
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SMACNA	Sheet Metal and Air Conditioning Contractor’s National Association
SSPWC	Standard Specification for Public Works Construction
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
UPRR	Union Pacific Railroad
USDARD	Rural Development (U.S. Department of Agriculture) (formerly Farmers Home Administration)
WCRSI	Western Concrete Reinforcing Steel Institute
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

01090.2 REFERENCED WORKS, CODES AND STANDARDS

Whenever references to specifications, codes, standards and other publications are made to these Specifications, the following rules shall apply:

01090.2.1 TITLES OF SECTIONS AND PARAGRAPHS

Titles of sections and/or paragraphs shown in these Specifications are for convenience of reference only, and do not form a part of the Specification.

01090.2.2 APPLICABLE PUBLICATIONS

Whenever references in these specifications are made to published specifications, codes, standards, or other requirements, it shall be understood that unless a date is specified, only the latest edition of these specifications, codes, and/or standards which have been published as of the date that the work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.

01090.2.3 SPECIALISTS AND SPECIAL ASSIGNMENTS

In certain instances, specification text requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such direction shall be recognized as special requirements and is not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" and qualified for the assignment of the work. Nevertheless, the final responsibility for fulfilling this assignment remains with the CONTRACTOR.

01090.2.4 BUILDING CODES

Reference herein to "Building Code" shall mean the Uniform Building Code issued by the International Conference of Building Officials (ICBO). The latest edition of the code as approved and used by the local agency as of the date of award, as adopted by the agency having jurisdiction, shall apply to the work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

01090.2.5 OSHA

01090.2.5.1 OSHA REGULATIONS - References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

01090.2.5.2 OSHA STANDARDS - References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards of the U.S. Code of Federal Regulations, including all changes and amendments thereto.

01090.2.6 DOT STANDARDS/SPECIFICATIONS

References to "State DOT Specifications" or "State DOT Requirements" shall mean the Specifications for Excavation on State Highway Right-of-Way and/or Standard Specifications for Road and Bridge Construction, including all amendments thereto, issued by the State agency responsible for highways wherein the Contract is located and any other written requirements or provisions issued by that agency which are contained in these Contract Documents.

01090.2.7 FEDERAL PIPELINE SAFETY STANDARDS

Reference to "Federal Pipeline Safety Standards" shall mean Title 29, Parts 191 and 192, Federal Pipeline Safety Minimum Standards, U.S. Code of Federal Regulations including all changes and amendments thereto.

01090.2.8 STATE GAS PIPELINE SAFETY STANDARDS

References to "State Gas Pipeline Safety Standards" shall mean the appropriate section/s of the legal code or regulations adopted in the State wherein the work is located, including all changes and amendments thereto.

01090.3 STANDARDS IMPOSED BY OTHER AGENCIES OR ORGANIZATIONS

01090.3.1 PROPERTY BELONGING TO OTHER AGENCIES OR ORGANIZATIONS

Construction may occur on property owned or administered by agencies or organizations other than the OWNER, such as federal and/or state departments of transportation, the U. S. Forest Service, the U. S. Bureau of Land Management, the U.S. Fish and Wildlife, counties, canal companies, irrigation companies, utility companies, other federal and state agencies, municipal governments, etc. Work which is to take place on such property may be required to be in accordance with special construction requirements of that agency or organization as well as these specifications.

01090.3.2 ADDITIONAL INFORMATION AND SPECIFICATIONS

Information will be provided on the plans to indicate areas of the Work which fall on property owned or administered by agencies and organizations other than the OWNER. Specifications from agencies which are affected by the work will be provided in the Appendix to the Contract Documents. Those specifications provided in the Appendix shall be considered part of the Contract Documents and the CONTRACTOR shall include sufficient compensation in its bid to cover the work required for compliance thereto.

01090.4 CONFLICTS

In case of conflict between codes, reference standards, Drawings and the other Contract Document, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER for clarification and directions prior to ordering or providing any materials or labor required therefrom. The CONTRACTOR shall assume the most stringent requirements apply when preparing bids for this Contract.

01200.1 DESCRIPTION

The purpose of this section is to clarify certain aspects of the Project and the Contract that must be taken into consideration and completed before final acceptance of the Work can be given. These items include cleanup, demonstration of acceptable performance of equipment and facilities furnished and installed, submittals, payment for all work completed, issuance of final acceptance documentation, accepted repair and restoration of work and materials found defective during the warranty period. Specific instructions are provided herein for completion of the Work in such a manner that it will be fully acceptable and that the CONTRACTOR will be eligible for receipt of final payment.

01200.1.1 RELATED WORK AND REFERENCED SECTIONS

Not used.

01200.1.2 SUBMITTALS

Section 01300 - Submittals
See paragraph 01200.3.5 below.

01200.1.3 DEFINITIONS

Not used.

01200.2 MATERIALS

Not used.

01200.3 CONSTRUCTION REQUIREMENTS

01200.3.1 CLEANUP

The OWNER will not give final acceptance of the Work until the CONTRACTOR has satisfactorily complied with the finishing and cleanup requirements contained in these Contract Documents and with any applicable local regulations. The CONTRACTOR shall accomplish the cleanup operations so as to leave the work site in an orderly, acceptable, and presentable condition.

01200.3.2 REPAIR AND RESTORATION

All major and minor damage to improvements and finished surfaces resulting from the CONTRACTOR's performance of the Work, whether to materials and equipment located on the project site or to those constructed under this Contract, shall be repaired to an original, or like-new, condition before final acceptance will be provided by the ENGINEER and OWNER. Where damage to surfaces or materials can not be sufficiently repaired or restored, in the opinion of the ENGINEER, the CONTRACTOR may be required to replace the entire surface covering or structural member to achieve an original or like-new condition of the surface or material.

01200.3.3 TESTING

All performance and operational testing of facilities and equipment required by the Contract Documents, together with any required supportive documentation, shall be completed by the CONTRACTOR and approved by the ENGINEER prior to final acceptance of the Work.

01200.3.4 ACCEPTANCE FROM PROPERTY OWNER

The CONTRACTOR shall obtain a written release from each property owner on whose property work has been required by these Contract Documents. Such release shall indicate the property OWNER's approval of the restoration and/or replacement of all disturbed improvements, surfaces and structures. Any request made to the CONTRACTOR by a private property owner and determined to be unreasonable in the opinion of the ENGINEER, may be waived by the OWNER.

01200.3.5 SUBMITTAL OF MANUFACTURER'S DOCUMENTATION

All guarantees and warranties, operation and maintenance manuals or brochures, or other materials furnished to the CONTRACTOR by the manufacturer for any equipment or material used for the Work shall be delivered to the OWNER in protective 3-ring binders. Retainage held to the CONTRACTOR in accordance with the General Conditions of the Contract Documents will not be released until such documentation is submitted. See Section 01300 for more detail regarding O&M manuals.

01200.3.6 FINAL ACCEPTANCE

01200.3.6.1 CONTRACTOR'S STATEMENT OF COMPLETION - When the CONTRACTOR has completed the Work under this contract, including all of the CONTRACTOR's testing and clean-up, the CONTRACTOR shall inform the ENGINEER in writing that the Work has been completed and request a final inspection by the ENGINEER. The ENGINEER will then conduct a final inspection with the OWNER and representatives of the pertinent funding and regulatory agencies. If items are found by the ENGINEER to be incomplete or not in compliance with the contract requirements, the ENGINEER will inform the CONTRACTOR of such items. After the CONTRACTOR has completed these items, the procedure shall then be the same as described above for the CONTRACTOR's statement of completion and request a final inspection.

01200.3.6.2 NOTICE OF FINAL ACCEPTANCE - After the ENGINEER has determined that all work required under the Contract Documents has been completed and that all of the considerations specified herein above are satisfactorily concluded, the ENGINEER will recommend to the OWNER, in writing, that final acceptance of the entire Work under this contract be made as of the date of the ENGINEER's final inspection. The OWNER and ENGINEER will then indicate formal approval and acceptance of the Work by issuing the "Notice of Final Acceptance" form.

01200.3.6.3 NO PARTIAL ACCEPTANCE - Unless otherwise required by Special Provisions, partial acceptance of any portion of the Work will not be made. While Substantial Completion notice can be issued in accordance with the General Conditions to allow use of completed work for its intended purpose, no acceptance other than the final acceptance of all completed work will be made. No inspection or approval or Notice of Substantial Completion pertaining to specific parts of the work shall be construed as final acceptance of any part until written final acceptance of all work is issued.

01200.4 METHOD OF MEASUREMENT

Not used.

01200.5 BASIS OF PAYMENT

Not used.

01300.1 DESCRIPTION

This section covers procedures to be followed by the CONTRACTOR when providing information to the OWNER and/or ENGINEER to obtain approval of materials, equipment, procedures, etc. described in the Specifications and Drawings.

01300.2 SHOP DRAWINGS AND MATERIALS SUBMITTALS

01300.2.1 NUMBER OF COPIES OF SUBMITTALS

The CONTRACTOR shall furnish six (6) copies of each shop drawing and pertinent materials information sheet to the ENGINEER for review. A full set of submittals shall be provided to the ENGINEER seven (7) days prior to commencement of construction activity. Following review and approval, two copies shall be returned to the CONTRACTOR for his records, two shall be retained by the ENGINEER for inspection and verification purposes, and two shall go to the OWNER as working and archival records.

01300.2.2 SHOP DRAWINGS

01300.2.2.1 CONTRACTOR REVIEW - The CONTRACTOR's shop drawing submittals shall be reviewed by a qualified representative of the CONTRACTOR, prior to submission to the ENGINEER. Such review shall be made to ensure the accuracy and compliance with the technical requirements and performance described and illustrated in the Drawings and Specifications.

01300.2.2.2 CONTENT - Shop drawings shall include drawings, pictures and sketches with sufficient details and explanations to reflect the CONTRACTOR's interpretations of components and required configurations not shown on the Drawings, so that a documented record of such can be approved for incorporation in the Work. These Drawings shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items and unit assemblies in relation to the Drawings and/or Specifications.

01300.2.2.3 TIMELY SUBMITTAL - Shop drawings shall be submitted sufficiently in advance to allow the ENGINEER not less than ten regular working days prior to manufacturing for examining the Drawings.

01300.2.2.4 ENGINEER APPROVAL - When the shop drawings are approved by the ENGINEER, two sets of copies will be returned to the CONTRACTOR marked "Approved", "Revise as Noted", "Rejected", "Approved Except as Noted", or similar notification. If changes or corrections are necessary, one set will be returned to the CONTRACTOR with such changes or corrections indicated by a brief statement, and the CONTRACTOR shall correct and resubmit the Drawings, in triplicate, to the ENGINEER.

Fabrication work shall not commence until the ENGINEER has reviewed the pertinent shop drawings and returned copies to the CONTRACTOR marked either "Approved" or "Approved - Except as Noted". Corrections indicated on such submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

Approval of shop drawings will not be required for reinforcing steel that is detailed by the CONTRACTOR in accordance with the Plans and Specifications. Any change from the Plans and Specifications made by the CONTRACTOR in any aspect of the Work shall be approved by the ENGINEER in a written Change Order prior to any work being altered from that already approved for construction.

001300.2.3 MATERIALS INFORMATION SUBMITTALS

In keeping with 01300.2.1 above, the CONTRACTOR shall assemble and submit six (6) original copies of each manufacturer's catalog cuts and materials information sheets pertaining to materials and equipment to be furnished and installed in the Work. These submittals shall be enclosed in 3-ring binders. Failure to submit all materials information may result in the CONTRACTOR's partial payments to be withheld until submittals are complete. Photocopies of the catalog cuts and information sheets will not be acceptable as submittals without prior authorization from ENGINEER.

01300.2.4 CONTRACTOR LIABILITY

The CONTRACTOR shall assume all responsibility and risk for any re-work or other costs resulting from errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for showing accurate dimensions and details of connections required to ensure the function of the equipment and/or component of the Work being illustrated.

01300.3 SAMPLES

01300.3.1 NUMBER OF SUBMITTALS

Whenever requested by the ENGINEER, the CONTRACTOR shall submit at least one sample of each item or material indicated in the Specifications to the ENGINEER for inspection and acceptance and do so at no additional cost to the OWNER.

01300.3.2 TIMELY AND ORDERLY SUBMITTAL

Samples shall be submitted sufficiently in advance of placement of orders that the ENGINEER shall have not less than ten regular working days for examining and testing the material for acceptance prior to delivery to the job site. Samples shall be submitted in an orderly sequence and appropriately identified so that dependent materials or equipment can be assembled and reviewed without causing delays in the work or mistakes in their identity.

01300.3.3 SELECTION OF COLORS AND TEXTURES

Unless otherwise specified, the OWNER and the ENGINEER will select all colors and textures of specified items from the manufacturer's standard colors and standard materials, products, or equipment lines.

01300.4 OPERATIONS AND MAINTENANCE MANUALS

01300.4.1 STRUCTURE OF OPERATIONS AND MAINTENANCE MANUALS

The CONTRACTOR shall furnish to the OWNER four (4) identical sets of Operations and Maintenance manuals. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl plastic, hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A Table of Contents shall be provided which indicates all equipment in the Operations and Maintenance manuals.

01300.4.2 CONTENTS

The CONTRACTOR shall include in the Operations and Maintenance Manuals the following information for each item of mechanical, electrical, and instrumentation equipment:

- Care and maintenance of all finished exposed surfaces.
- Complete operating instructions, including location of controls, special tools or other equipment required, related instrumentation, and other equipment needed for operation.
- Preventive maintenance procedures and schedules.
- Complete parts lists, by generic title, identification number, and catalog number, complete, with exploded views of each assembly.
- Disassembly and reassembly instructions.
- Name and location of nearest supplier and spare parts warehouse.
- Name and location of manufacturer.
- Recommended start-up, testing and troubleshooting procedures.
- Prints of the record drawings, including diagrams and schematics, as required under the electrical and instrumentation portions of these specifications.

01300.4.3 SCHEDULE OF DELIVERY

Operations and Maintenance manuals shall be submitted in final form to the OWNER before seventy-five (75) percent of the Work is completed. Any discrepancies found by the OWNER and ENGINEER in the Operations and Maintenance manuals shall be corrected by the CONTRACTOR prior to final acceptance of the project.

01300.5 SCHEDULE OF VALUES

At the time of the pre-construction conference, the CONTRACTOR shall submit a Schedule of Values of the Work measured as lump sum bid items. On the Schedule, those items shall be subdivided into component parts in sufficient detail as to form a basis for determining progress payments during construction. Quantities, and/or prices, shown on the Schedule shall equal the total contract price for each lump sum item. Information provided on the Schedule will be reviewed and approved by the ENGINEER when found acceptable. That information will then be incorporated into the data used for preparing the Application for Payment by the ENGINEER.

01300.6 CONTRACT CONSTRUCTION SCHEDULE

A construction schedule, prepared in accordance with requirements of the General Conditions, shall be submitted to the ENGINEER at the pre-construction conference. Unless required otherwise in Special Provisions, such schedule shall show the anticipated time of completion, approximate start dates of identifiable segments of the Work, and anticipated value of the work expected to be completed in monthly time periods within the contract period.

01300.7 PROCUREMENT SCHEDULE

At the time of the pre-construction meeting (see Section 01030), the CONTRACTOR shall submit a procurement schedule to the ENGINEER. This plan shall include all equipment and materials required for the Work included in the Contract that are not readily available and will require off-site manufacture and lead time which can affect the progress of the Work. The plan shall show at least the following information:

- Equipment/Material Name
- Anticipated amount of time for ordering, manufacturing, and shipping to Work site.
- Anticipated dates for ordering, receiving and installing.

01300.8 CONSTRUCTION PHOTOGRAPHY RECORDS

When required in the Contract Documents and prior to commencement of any of the Work, the CONTRACTOR shall prepare colored CD photography records of all areas of the Contract work site and provide copies of such records to the ENGINEER. Such records shall become the property of the OWNER and may be used for determining the condition of work sites and degree of restoration required for completion of the Work (see also Section 2000).

01400.1 DESCRIPTION

This section covers quality control of all Work and activities on the part of the OWNER, the ENGINEER, and the CONTRACTOR, to ensure compliance with these Specifications and the requirements of the Contract.

01400.2 ASSIGNMENT OF RESPONSIBILITY

01400.2.1 THE CONTRACTOR

The CONTRACTOR has primary responsibility for ensurance of quality control of the Work provided under the Contract. Therefore, any omission or failure on the part of the ENGINEER to notify the CONTRACTOR of, or to condemn defective work and/or materials at the time of construction shall not be taken as acceptance of the Work or materials, and the CONTRACTOR will be required to correct any defective work or materials prior to final acceptance.

01400.2.2 THE OWNER AND ENGINEER

The ENGINEER will endeavor to locate any errors or defective materials or workmanship, and call them to the attention of the CONTRACTOR prior to subsequent Work being performed. However, the ENGINEER is under no obligation to do so, and neither the OWNER, nor the ENGINEER shall be held liable for errors, or defective material, or defective workmanship performed by the CONTRACTOR and not discovered by the ENGINEER prior to subsequent Work being performed.

01400.2.3 CORRECTIONS

Prior to execution of the Agreement, the ENGINEER may correct errors and omissions to these Contract Documents by issuing Addenda. After execution of the Agreement, correction of errors, omissions or other changes necessitated shall be made in accordance with the General Conditions (Section 00700).

01400.3 QUALITY OF MATERIALS

01400.3.1 COMPLIANCE WITH SPECIFICATIONS

All materials and equipment incorporated in the Work shall be of new manufacture and shall be of the grade and quality described by these Specifications and the Special Provisions.

01400.3.2 SPECIFIED MATERIALS

Where a specific brand or manufacturer's equipment, model, system, or etc. is specified in these Specifications, no intention is made to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance.

01400.3.3 SUBSTITUTION OF MATERIALS

The ENGINEER, in accordance with the Instructions to Bidders (Section 10.01), may allow substitution of equipment or materials. The OWNER reserves the right to reject substitutions if, in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

01400.4 QUALITY OF WORK

All workmanship incorporated in the Work covered by the Contract is to be of the grade and quality described by these Specifications and the Special Provisions.

01400.5 OBSERVATION

01400.5.1 AUTHORITY AND DUTIES OF OBSERVERS

01400.5.1.1 AUTHORITY - Observers representing the ENGINEER are authorized to observe all Work performed and all materials furnished and to reject defective material and any Work that is improperly performed, subject to the final decision of the ENGINEER. This authority extends to all or any part of the Work, including the preparation, fabrication, or manufacture of any materials or equipment to be used for completion of the Work. The Observer is not authorized to alter or waive the provisions of these Specifications or other provisions of the Contract Documents. The ENGINEER may delegate additional authority to the Observers when such action is determined to be necessary.

01400.5.1.2 DUTIES - Observers keep the ENGINEER informed as to the progress of the Work and the manner in which it is performed. Observers are also assigned to call the CONTRACTOR's attention to any observed nonconformance with the Contract Documents. The Observer will not act as foreman for the CONTRACTOR.

01400.5.2 OBSERVATION OF MATERIALS

01400.5.2.1 TESTING - In accordance with the Contract Documents and at the option of the ENGINEER, materials to be supplied under this contract will be tested and/or inspected either at their place of origin or at the site of the Work. The CONTRACTOR shall give the ENGINEER written notification well in advance of actual readiness of materials to be tested and/or inspected at the point of origin. Satisfactory tests and inspections at the point of origin shall not be construed as a final acceptance of the material nor shall it preclude re-testing or re-inspection at the site of the Work.

01400.5.2.2 SAMPLES - The CONTRACTOR shall furnish such samples of materials as are requested by the ENGINEER, without charge. No material shall be incorporated into the Work until the ENGINEER has approved it (see Section 01300).

01400.5.3 CONTRACTOR LIABILITY

The observation of the Work shall not relieve the CONTRACTOR of any of its obligations to fulfill its contract as herein provided, and unsuitable materials may be rejected notwithstanding that such unsatisfactory performance may have been overlooked and accepted or estimated for payment.

CHARACTER OF WORKERS, METHODS AND EQUIPMENT — SECTION 01500

01500.1 DESCRIPTION

Covers requirements for aptness, competency, quality, and quantity in the labor, equipment, tools, and materials supplied by the CONTRACTOR for execution of the Work.

01500.2 REQUIREMENTS

In order to bring the Work to completion in the manner and on the time schedule required by the Contract Documents, the CONTRACTOR shall provide sufficient labor and equipment with adequate training and capability as follows:

- The CONTRACTOR shall employ sufficient labor and equipment with adequate training and capability for executing the Work to full completion in the manner and time required by these Specifications.

- All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have appropriate training and sufficient experience in such work, in the opinion of the ENGINEER, to perform all work properly and satisfactorily.

- Any person employed by the CONTRACTOR or by any Subcontractor who, in the opinion of the ENGINEER, does not perform their work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the ENGINEER, be removed forthwith by the CONTRACTOR or Subcontractor employing such person. Such person(s) shall not be employed again in any portion of the Work without the approval of the ENGINEER. When such action is considered, and if requested by that employee, a hearing attended by the employee, ENGINEER, and CONTRACTOR shall be conducted before final dismissal action is taken.

- Should the CONTRACTOR fail to remove such person or persons as required above or fail to furnish suitable and sufficient personnel for the proper execution of the Work, the ENGINEER may suspend the Work by written notice until such order is complied with.

- All equipment, which is proposed to be used on the Work, shall be of sufficient size and in such mechanical condition, in the opinion of the ENGINEER, as to produce a satisfactory quality of Work. Equipment used on any portion of the Work shall be fitted with appropriate protective devices in accordance with OSHA and other applicable safety regulations such that no injury to employees, the Work, or to adjacent property will result from its use.

- When the specific methods and equipment to be used by the CONTRACTOR in accomplishing the Work are not described in the Contract Documents, the CONTRACTOR is free to use any methods or equipment that will accomplish the Work in conformity with the requirements of this Contract.

PROTECTION OF EXISTING IMPROVEMENTS — SECTION 01510

01510.1 DESCRIPTION

This section covers measures and instructions for prevention of damage to existing structures and utilities, whether above ground or underground, during execution of the Work of the Contract.

01510.2 PROTECTION OF EXISTING UTILITIES

01510.2.1 INTEGRITY OF UTILITIES

The CONTRACTOR shall be responsible for safeguarding and maintaining the integrity of all conflicting utilities. This responsibility includes securing the assistance of available utility location services in the area in which the Work is being performed. The ENGINEER has attempted to show the location of all utilities anticipated to conflict with the Work. However, when a conflicting utility line is discovered that was not shown on the Plans, the CONTRACTOR shall contact the utility's OWNER and notify the ENGINEER immediately for resolution of the conflict. When realignment or relocation of the Work, or relocation of the conflicting utility is deemed necessary, the ENGINEER shall give direction in writing for the CONTRACTOR to proceed. Work resulting from such direction may be treated as a changed condition, and appropriate authorization and payment will be made in accordance with the General Conditions.

01510.2.2 LOCATING UTILITIES

It shall be the responsibility of the CONTRACTOR to locate and expose or identify all existing utilities, both underground and overhead, for the purpose of preventing damage to them. The CONTRACTOR shall notify all concerned utility offices at least 48 hours in advance of construction operations in which a utility agency's facilities may be involved. This shall include, but not be limited to, irrigation water, culinary water, telephone, gas, and electric.

01510.2.3 CHANGES TO UTILITIES

The CONTRACTOR shall be responsible for any and all changes to, or re-connections to, public utility facilities encountered or interrupted during execution of the Work, and all costs related thereto shall be borne by the CONTRACTOR. The CONTRACTOR shall negotiate with, and pay, the respective utility agency for work it must do in connection with moving, repairing, or restoring its utility(s). The CONTRACTOR shall further make all necessary notifications, scheduling, coordination, and management of details related to any such interference. The potential or projected cost of any public utility interference shall be included in the CONTRACTOR's price covering the major Contract Item to which the interference or changes are attributable.

01510.2.4 MAINTENANCE OF SERVICE

01510.2.4.1 CONTINUOUS SERVICE - Unless otherwise required in the Contract Documents, all utilities, both underground and overhead, shall be maintained in continuous service throughout the entire contract period. The CONTRACTOR shall be responsible and liable for any damages to or interruption of service caused by the construction.

01510.2.4.2 ACCIDENTAL INTERRUPTION OF SERVICE - In the event of interruption of other utility services as a result of accidental breakage, the CONTRACTOR shall promptly notify the appropriate responsible authority. The CONTRACTOR shall then cooperate with that authority in restoration of service as soon as possible and shall bear all cost of repair. In no case shall interruption of any water or other utility service be allowed outside working hours unless the ENGINEER has issued prior authorization. When changeover of service connections to new

utility lines becomes necessary, interruptions of individual services for periods of up to 8 hours will be allowed providing 24 hour advance notice has been given to affected users.

01510.2.4.3 TEMPORARY INTERRUPTION AND RELOCATION - If the CONTRACTOR desires to temporarily or permanently relocate or shut down any utility or appurtenance, the CONTRACTOR shall make the necessary arrangements and agreements with the owner or operator of the respective utility and shall be completely responsible for all costs concerned with the relocation or shutdown and reconstruction. Shutdown and relocation and/or reconstruction shall be subject to inspection and approval by the ENGINEER and the owner of the utility.

01510.3 PROTECTION OF PROPERTY AND EXISTING STRUCTURES

01510.3.1 REMOVAL OR RELOCATION OF PROPERTY - All property removed or relocated by the Work shall be reconstructed in its original or new location as soon as possible. Restoration of existing property or facilities shall be to a condition as good or better than its original condition.

01510.3.2 DAMAGE TO PROPERTY - All property damaged by the CONTRACTOR, whether inside or outside the limits of easements provided by the OWNER, shall be the responsibility of the CONTRACTOR. All such damages shall be repaired with like material and restored to its original condition, or better. Such repair or restoration shall be accomplished at the CONTRACTOR's expense without additional compensation from the OWNER.

01510.4 PROTECTION OF PAVED SURFACES

To avoid unnecessary damage to paved surfaces, tracked equipment shall use rubber cleats or paving pads when operating on or crossing all existing paved surfaces unless authorized otherwise in writing by the ENGINEER.

01510.5 RIGHTS-OF-WAY AND EASEMENTS

01510.5.1 MINIMAL DISTURBANCE OF RIGHTS-OF-WAY - When construction easements have been obtained by the OWNER, the CONTRACTOR shall take appropriate measures to minimize disturbances to surface improvements within the easements. The CONTRACTOR shall obtain a signed release from each property owner, approving restoration work in the construction easements across its respective property(s).

01510.5.2 CONSTRUCTION AREAS - The CONTRACTOR shall confine construction operations to the area within the dedicated rights-of-way for public thoroughfares, or within areas for which construction easements have been obtained, unless the CONTRACTOR has made separate special agreements with the affected property owners in advance.

01510.5.3 PROPERTY OWNER NOTIFICATION - The CONTRACTOR shall give at least 48 hours advance notification of commencement of construction to property owners having land on which construction will take place. During all construction operations, the CONTRACTOR shall construct and maintain such facilities as may be required to provide access by all property owners to their property. No one shall be cut off from access to their property for a period exceeding eight (8) hours unless the CONTRACTOR has made special arrangements with the affected persons. The CONTRACTOR shall grade all disturbed surfaces required for motor vehicle traffic at least daily unless directed otherwise in the Contract Documents or in writing by the ENGINEER.

01520.1 DESCRIPTION

This Section includes requirements that shall be followed by the CONTRACTOR, to protect the environment, while performing work under this contract. The CONTRACTOR shall also comply with any applicable additional requirements made by federal, state, or local government agencies.

01520.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 00700 – General Conditions, paragraph 32 (for RDA funded projects)

01520.1.2 SUBMITTALS

Section 01300 – Submittals.

01520.1.3 DEFINITIONS

Not used.

01520.2 MATERIALS

Not used.

01520.3 CONSTRUCTION REQUIREMENTS

01520.3.1 EXPLOSIVES AND BLASTING

The use of explosives on the work will not be permitted unless approved otherwise in the Contract Documents or in writing by the ENGINEER.

01520.3.2 DUST ABATEMENT

01520.3.2.1 CONTROL MEASURES - The CONTRACTOR shall furnish all labor, equipment, water and means required to provide effective dust control and abatement measures. Control measures shall be applied as often as necessary and wherever directed in writing by the ENGINEER, to prevent construction operations from producing dust in amounts that may be damaging to property, vegetation, or animals, or detrimental to persons within reasonable proximity of the work site.

01520.3.2.2 HAUL ROUTES AND WORK SITES - The CONTRACTOR shall identify haul routes or material handling areas, outside of the Work site, whereon dust may be generated, and shall exercise appropriate measures to abate any dust problem caused by its operation. Such dust abatement measures shall be taken immediately when observed or when required in writing by the ENGINEER.

01520.3.3 STORM AND GROUND WATER

01520.3.3.1 PERMITS REQUIRED - If a storm water NPDES permit is required, the CONTRACTOR is responsible to obtain such permit and comply with the conditions thereof.

01520.3.3.2 CONTROL MEASURES - The CONTRACTOR shall provide and maintain, at all times during construction, ample means and devices to promptly remove all water entering the Work, whether the water is surface or ground water. Water removed by the CONTRACTOR shall be directed into ponds or areas separated from live streams or drainage ways, to keep sediment from entering live water.

01520.3.3.3 DRAINAGE PATTERNS - In excavation, fill, and grading operations, the CONTRACTOR shall take care, to disturb the existing drainage pattern as little as possible. Particular care shall be taken not to direct drainage water onto private property or into streets or drainage ways inadequate for the increased flow.

01520.3.3.4 FORDING OF WATERWAYS - Fording of live streams or any body of live water to accomplish the Work shall not be permitted. Mechanized equipment also shall not be operated in live water to accomplish the Work unless authorized in writing by the ENGINEER, or in the Contract Documents.

01520.3.3.5 FILLING OF WATERWAYS - The ENGINEER will not approve the filling of any ditches, washes, drainage ways, streams, wetlands, or other surface waters by the CONTRACTOR to accomplish the Work unless specific instructions are included in the Contract Documents which will provide for how the affected drainages or surface waters are to be treated.

01520.3.4 NOISE ABATEMENT

In or near inhabited areas, particularly residential areas, the CONTRACTOR's operations shall be performed in a manner to prevent noise from becoming a nuisance or problem. Particular consideration shall be given to noise generated by repair and service activities during the night hours.

01520.3.5 CHEMICALS

All chemicals and/or petroleum based products used during project construction or furnished for project shall be handled, applied and disposed of in strict accordance with the printed instructions of the manufacturer and regulations enforced by Federal, State and Local health authorities.

01520.3.6 WASTE AND SURPLUS MATERIALS DISPOSAL

01520.3.6.1 CLEAN WORK SITE - The CONTRACTOR shall keep the work site, haul roads and other areas of use in a neat, clean condition, free from any accumulation of surplus materials. It shall be the responsibility of the CONTRACTOR, at its own expense, to remove and legally dispose of all surplus materials resulting from all Work activities performed in accordance with the Contract Documents.

01520.3.6.2 SURPLUS MATERIAL - Surplus material includes, but is not limited to, salvaged materials and equipment that otherwise would have been abandoned in place, rocks too large to be used as backfill, wood and other organic or unsuitable materials, trash, rubbish, and waste products of any nature, and any other debris generated by the Work.

01520.3.6.3 REGULATORY COMPLIANCE - Disposal of surplus materials shall be accomplished in accordance with all local codes, laws, ordinances, and all applicable safety laws (particularly to the requirements of Part 1926 of the OSHA Safety and Health Standards for Construction) in affect at the approved disposal site. In no case shall it be acceptable for any surplus material to be disposed of in streams, marshes or wetlands.

01520.3.6.4 APPROVAL OF DISPOSAL - The ENGINEER will not approve any disposal operation, which creates an unsightly and/or unsanitary nuisance. The CONTRACTOR shall maintain disposal sites in a reasonable condition of appearance during construction. When designated and/or public disposal sites are unavailable, written approval must be obtained from the ENGINEER to dispose of any surplus materials on any other site. All disposal sites are subject to approval by the ENGINEER. The CONTRACTOR shall secure permission and all permits required for use of any dumpsite not previously arranged and designated by the OWNER. The CONTRACTOR shall

retain copies, and provide copies upon request, of all disposal permits and/or agreements obtained for the Contract Work.

01520.3.6.5 SCHEDULED REMOVAL - The CONTRACTOR shall establish regular intervals of collection and disposal of surplus materials during construction. Stockpiling of surplus materials for later disposal will not be approved or allowed.

01520.3.7 OPEN BURNING

Open burning of materials may be allowed only in strict accordance with all regulations in effect for the area at which the burning would be performed, and the CONTRACTOR shall obtain any necessary permits from the appropriate governing entity prior to the start of burning. The CONTRACTOR shall not allow fire to spread beyond the material intended for burning. No accumulation of residue from burning shall remain on or adjacent to the construction site, without written approval of the ENGINEER.

01520.3.8 SANITATION

01520.3.8.1 TOILETS - The CONTRACTOR shall provide fixed or portable chemical toilets for employee use in conformance with the requirements of Part 1926 of the OSHA Standards for Construction and when public toilets are not available or within fifteen (15) minutes walking distance of the Work site.

01520.3.8.2 COLLECTION OF WASTES - The CONTRACTOR shall be responsible for daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the CONTRACTOR shall be disposed of away from the site in accordance with all laws and regulations pertaining thereto.

01520.3.9 HAZARDOUS MATERIAL

01520.3.9.1 REGULATORY COMPLIANCE - Disposition of any hazardous material or toxic or hazardous waste shall be made in accordance with the requirements and regulations administered by the State agency wherein the Work site is located.

01520.3.9.2 ABNORMAL CONDITIONS - Abnormal conditions include, but are not limited to, the following: buried barrels with liquid or solid contents; buried or above ground tanks with liquid contents; obnoxious odors; excessively hot earth; stained and discolored soils; smoke; unidentifiable powders, sludge, pellets; or any other similar condition.

01520.3.9.3 DISCOVERY AND NOTIFICATION - If any abnormal conditions are encountered during construction, which indicate the presence of a hazardous material, toxic, or hazardous waste, the CONTRACTOR shall immediately suspend work in the area of the discovery and notify the ENGINEER and treat the situation with extreme caution. The CONTRACTOR's operation in the area of discovery shall not resume until so directed by the ENGINEER; however, the CONTRACTOR shall continue working in other areas of the project, unless otherwise directed by the ENGINEER.

01520.3.9.4 DISPOSAL - When it becomes necessary for the CONTRACTOR to dispose of discovered materials, the work may be considered a change and administered in accordance with the General Conditions. Should the disposition of discovered waste material require special procedures or handling by certified personnel, the CONTRACTOR will make all such arrangements. When it becomes necessary to obtain permits for transporting or handling discovered material, the OWNER will obtain the permits.

01520.3.9.5 SPILLS AND NOTIFICATION - In the event of spills of petroleum-based products or hazardous wastes by the CONTRACTOR, the CONTRACTOR shall immediately notify the ENGINEER. The CONTRACTOR shall also notify the appropriate State environmental enforcement agency, unless the spill consists of less than one (1) gallon of petroleum based products. In no case will notification be made later than 24 hours after the discovery of the spill. In addition, written notification shall also be made within 5 calendar days of the discovery.

01520.3.9.6 COST OF CLEANUP - All costs for cleanup and disposal of hazardous materials due to spills, inappropriate handling, or negligence of the CONTRACTOR shall be borne by the CONTRACTOR.

01520.3.10 ENVIRONMENTAL COMPLIANCE

01520.3.10.1 REGULATORY COMPLIANCE - The CONTRACTOR shall comply with the applicable requirements of the National Historic Preservation Act as it relates to the preservation of ALL environmental resources. Clearance for protection of environmental resources located within the designated Work site is the responsibility of the OWNER and such clearance has been obtained for the Contract, unless provided for otherwise in the Contract Documents.

01520.3.10.2 DISCOVERY OF HISTORIC/ARCHEOLOGICAL OBJECTS – The CONTRACTOR shall observe the following:

- DISCOVERY AND NOTIFICATION - If a suspected or unsuspected historic, archeological, or paleontological item, feature, or site is encountered, construction operations shall be immediately stopped in the vicinity of the discovery and the ENGINEER shall be notified of the nature and exact location of the findings. The CONTRACTOR shall not damage the discovered objects and shall provide written confirmation of the discovery to the ENGINEER within two (2) calendar days.

- RESTRICTION OF CONSTRUCTION - Should operations in the vicinity of a discovery be restricted, the ENGINEER will keep the CONTRACTOR informed concerning the status of the restriction. The CONTRACTOR should be aware that the time necessary for the OWNER to negotiate the handling of the discovery is variable and is dependent on the nature and condition of the circumstances. It is possible that a delay of as much as three weeks in the vicinity of the discovery can be expected. The ENGINEER will inform the CONTRACTOR when the restriction is terminated. Changes required to accommodate delay or Work resulting from the discovery will be authorized in accordance with the General Conditions.

01520.3.11 OPERATIONS OUTSIDE OF THE PROJECT SITE

In the event the CONTRACTOR chooses to use any site or means of obtaining resources beyond those provided as part of the Contract, the CONTRACTOR shall retain the services of a qualified, certified environmental consultant to produce a research design or plan for obtaining any and all necessary environmental clearances for such use. The CONTRACTOR shall provide the plan to the ENGINEER for review and approval, as required, following which the plan shall be implemented. The CONTRACTOR shall submit evidence of environmental clearances and compliance before commencing any activities within the extended use area. At a minimum, clearances will include those listed below. Additional clearances may be required as necessary.

01520.3.11.1 CULTURAL RESOURCES (Archeological and Historic) - Clearance may require consultation with the State Historic Preservation Office.

01520.3.11.2 THREATENED AND ENDANGERED SPECIES - Compliance may require written clearance from the U.S. Fish and Wildlife Service.

01520.3.11.3 FLOOD PLAINS – May require consultation with the Federal Emergency Management Agency (FEMA) or corresponding state agency.

01520.3.11.4 WETLANDS AND OTHER BODIES OF WATER – May require consultation with the Army Corps of ENGINEERs and/or appropriate state agency.

The CONTRACTOR is cautioned that obtaining environmental clearances can be costly and time consuming.

01520.4 METHOD OF MEASUREMENT

Not used.

01520.5 BASIS OF PAYMENT

Not used.

SPECIAL PROVISION

CONSTRUCTION STAKING — SECTION SP01560

01560.1 DESCRIPTION

Construction staking procedures and responsibilities are broadly defined in the General Conditions and specific information is provided in this Section to define those procedures and responsibilities indicated in the General Conditions.

01560.2 QUALITY CONTROL

All construction staking, whether provided by the Contractor or the Owner, will be supervised by a land surveyor registered in the state in which the Work is located. Surveys will be performed consistent with professional practices and precision generally conducted by surveyors licensed in that state. Complete, legible survey notes will be maintained by the surveyors which show the locations and measurements required to establish construction staking. Such documents shall also provide information to identify the project, location of survey, date of survey, land surveyor's name and registration number. Copies of the Contractor's survey documentation shall be made available to the Owner upon request.

01560.3 OWNER RESPONSIBILITY

The Owner shall establish all base lines for locating the principal component parts of the Work together with a suitable number of bench marks adjacent to the Work as shown in the Contract Documents. From the information provided by the Owner, unless otherwise specified in the Contract Documents, the Contractor shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pipe locations and other working points, lines elevations, and cut sheets from information provided by the Engineer.

01560.3.1 FIELD LOCATION POINTS

Unless otherwise indicated in the Contract Documents, the Owner shall provide information on the Drawings and sufficient surveyed points in the field to locate all features and components of the Contract. Typically, field location points will be established to consist of the following:

01560.3.1.1 PRESSURE LINES - When pressure lines are located in established streets or areas with sufficient referencing features (curb, sidewalks, fence lines, etc.), no staking will be provided and location information shall be provided on the Drawings. When pressure lines are located in areas without sufficient referencing features, stakes will be set to establish the pipe centerline at 100-foot intervals. Where sloping of lines is critical (drain lines, etc.) cut stakes will be provided to indicate flow line elevation at beginning and ends of such lines.

01560.3.1.2 SEWER AND OPEN CHANNEL FLOW LINES AND MANHOLES - Manhole centerline locations will be shown with horizontal offset stakes and cut stakes to indicate the elevation of the flow line. In addition, cut stakes will be set to provide horizontal locations and grade 100-feet upstream on lines flowing into manholes.

01560.3.1.3 TANKS - Circular tank centerline location will be staked and a benchmark (grade) stake will be provided to establish floor top elevation. Exterior corners of rectangular tanks will be staked and a benchmark will be established for establishing floor top. Stakes locating rectangular tank corners will also be provided offset reference stakes.

01560.3.1.4 BUILDINGS AND OTHER STRUCTURES - Two reference points with offset reference stakes will be provided to establish horizontal location of one wall or the centerline. A benchmark (grade) stake will also be provided to establish vertical elevations of the building/structure/s components.

01560.3.1.5 ROADWAYS - In all roadway construction, offset stakes that identify location of the centerline of road will be set at intervals not to exceed 100-feet. When roadway construction requires specific grading, stakes will be set at the beginning points of cuts and fills with offset reference stakes. Hubs will be set to actual finished grades at the top edges of the subgrade and at each consecutive course of surfacing base. Hubs with offset reference stakes will be set on the centerline at the upstream and downstream lip of the flowline of all drainage pipes and structures. Staking intervals for roads with specified grading shall not exceed 100 feet in tangent sections and 50 feet in curved sections. When curbing and/or sidewalks are constructed along roadways, offset stakes with horizontal and vertical referencing information will be set at intervals of not more than 50 feet. Bench marks for checking and establishing vertical elevations shall be set at intervals not more than 1000 feet apart.

01560.3.1.6 PONDS AND LAGOONS - Offset stakes which identify the centerline and cut/fill stakes with offset reference stakes will be set at intervals of not more than 100 feet as well as at the beginning and end of all curved sections of banks. At least one benchmark shall be provided for each cell of the pond for establishing and verifying vertical elevations.

01560.3.2 COST OF ERRORS

The Owner shall be responsible for the accuracy of any staking, measurements, grades and alignment set by its own surveys. The Owner shall cover costs resulting from staking errors attributable to the Owner's survey.

01560.4 CONTRACTOR RESPONSIBILITY

The Contractor shall carefully preserve benchmarks, reference points and stakes. If willful or careless destruction to these stakes, marks or reference points results from the activities of the Contractor, the Contractor shall be charged with the resulting expense for their restoration and for any mistakes that may be caused by their loss or disturbance.

01560.4.1 ESTABLISHMENT OF GRADES, ETC.

The Contractor shall establish any grades, elevations, distances, fitting rotation and angles required for its construction operation from the control staking provided by the Owner and described above. The Contractor shall advise the Owner of anticipated conditions which will affect location of offset stakes and protect the control staking from its construction operation. Where control staking has been damaged or obliterated by the Contractor's operation, replacement of the staking shall be made in accordance with the provisions of the General Conditions.

01560.4.2 ERRORS IN CONSTRUCTION STAKING

When the Contractor observes discrepancies or errors in the control staking, such problems shall immediately be brought to the attention of the Engineer, and the Engineer shall take corrective action as necessary to resolve the problem.

01560.4.3 ACCURACY IN CONTRACTOR SURVEYING

The Contractor shall be responsible for the accuracy of any staking, measurements, grades, and alignments set by its own surveys. Any costs resulting from staking errors attributable to the Contractor shall be borne by the Contractor. The Engineer reserves the discretionary right to check the Contractor's staking, grades and measurements randomly at any time. When such checking is to be exercised, the Engineer will notify the Contractor of the location and the time at which the checking will commence. The Contractor shall then stop any respective part of the Work in progress until the Engineer has notified the Contractor that the checking has been completed and the Work has been found to be in accordance with requirements of the Contract Documents.

WORK SITE MANAGEMENT — SECTION 01580

01580.1 DESCRIPTION

In general, the CONTRACTOR is responsible for providing and maintaining access to the Work, handling and storing of materials and equipment, safety and security within the Work site, and coordination and cooperation with the OWNER, its representatives, governing authorities and other contractors working for the OWNER in accordance with the provisions of the General Conditions. This section contains specific requirements which apply to these responsibilities.

01580.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 02005 – Traffic Control

01580.1.2 SUBMITTALS

Not used.

01580.1.3 DEFINITIONS

Not used.

01580.2 WORK SITE ACCESS

01580.2.1 INVESTIGATION OF WORK SITE AREA

The CONTRACTOR shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting ingress and egress to the site of the work.

01580.2.2 HAUL ROADS

It shall be the CONTRACTOR's responsibility to construct and maintain any new haul roads required for its construction operations.

01580.2.3 USE OF PUBLIC STREETS AND ALLEYWAYS

Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public street, alleyway, or parking area during the performance of the Work, unless shown otherwise in the Contract Documents.

01580.2.4 CLOSURE OF PUBLIC ROADWAYS

No street, road, or highway shall be closed to the public without first obtaining permission from the proper governmental authorities and the ENGINEER. Where excavation is being performed in streets or highways, one lane in each direction shall be kept open to traffic at all times, unless otherwise authorized by the Contract Documents or the ENGINEER. Toe boards, or other measures, may be required by the ENGINEER to retain excavated material when deemed necessary.

01580.2.5 INTERFERENCE WITH UTILITIES

The CONTRACTOR shall so conduct operations as not to interfere unnecessarily with the infrastructure of utility companies or other agencies in such streets, alleyways, or parking areas.

01580.3 PUBLIC SAFETY AND ACCESS

Fire hydrants, approaches to fire stations, police stations and hospitals on or adjacent to the Work shall be kept accessible at all times. Appropriate measures shall be taken by the CONTRACTOR, to assure the use of sidewalks, and the proper functioning of all gutters, sewer inlets, water mains, drainage facilities and other infrastructure.

The CONTRACTOR's responsibility for Work safety or liability for Work site accidents is not lessened by the presence of the ENGINEER or his or another inspector performing monitoring of Work site safety conditions.

See also Section 02005 – Traffic Control.

01580.4 CONTRACTOR'S USE OF THE WORK SITE

The CONTRACTOR's use of the Work site shall be limited to its construction operations. Written approval by the ENGINEER will be required for any other use of the site, such as material and equipment storage, personnel vehicle parking, on-site fabrication facilities and field office.

01580.5 OFF-SITE STORAGE

The CONTRACTOR shall make arrangements for, bear any use costs associated with, and obtain written permission from the ENGINEER prior to using any off-site storage or shop areas or facilities determined necessary for execution of the Work. Storage facilities shall be equipped with fences and/or lockable entries that will prevent entry by unauthorized parties. Before off-site storage facilities are placed in use, the CONTRACTOR shall provided the OWNER keys or combinations to locking devices used to secure the facility.

01580.6 COOPERATION WITH OTHER CONTRACTORS

Prior to authorizing other CONTRACTORs to work on or adjacent to the Work site, the OWNER shall notify the CONTRACTOR in writing and provide the name and address of the CONTRACTOR, the name of its supervisor, a description of the work to be performed, and a schedule which shows the dates and planned segments of the work to be completed by the other CONTRACTOR. In the event that conflicts or interferences occur between the CONTRACTOR and the other CONTRACTOR's operation, the ENGINEER shall be notified immediately. The ENGINEER shall then take appropriate action needed to resolve the problem.

DIVISION 2

SITEWORK

SUNRISE
ENGINEERING

02000.1 DESCRIPTION

This section describes various tasks associated with project execution and close out. Mobilization shall include: preparatory work and materials necessary for obtaining clearances for the Work; moving personnel, equipment, supplies and incidentals to and from the Project Site; quality control; clean-up; temporary utilities and quarters; permits, bonds and insurance; dust abatement, storm water control, and noise abatement; waste and rubbish disposal and control; sanitation; and project close-out operations.

02000.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 01200 - Contract Closeout
Section 01510 - Protection of Existing Property
Section 01520 - Environmental Controls
Section 02005 - Traffic Control

02000.1.2 SUBMITTALS

02000.1.2.1 VISUAL RECORDS - The Contractor shall furnish at least one copy of all visual records, as described below in 02000.3.2, to the Owner.

02000.1.2.2 SERVICE CONNECTION LOCATION AND DOCUMENTATION – When service connections are included in the scope of work the Contractor shall deliver all signed tie-sheets (see 02000.3.3 below) to the Engineer not less than forty-eight hours prior to when the service connection is to be installed.

02000.1.3 DEFINITIONS

Sign - A complete assembly including panel and posts, with fasteners, installed at designated locations.

DVD Record - Photography on DVDs of areas potentially liable for disturbance as a result of the Work required by this Contract.

Service Connection Interview & Documentation - Interviews with potential system users and the documentation of location data for service connections to the respective property from utility lines being installed under this Contract.

Tie Sheets - Forms provided by the Engineer for use in documenting the location of service connection/s of system users.

Service Connection - Piping extending from the main utility line to the property line, or designated connecting point, of any user of the system.

02000.2 MATERIALS

02000.2.1 SIGN PANELS

5/8-inch thick (A or B) exterior grade plywood sheets with best quality exterior enamel paint for face painting and lettering, fastened to posts with at least four 1/2-inch galvanized bolts.

02000.2.2 POSTS

4x4 Cedar or treated Pine commercial fence posts at least eight-feet long or as shown on the Drawings.

02000.2.3 VISUAL RECORD

Records shall be made on professional quality, standard DVD format recording. DVD's shall be provided with protective covers and shall be labeled to indicate the area covered by the photography.

02000.3 CONSTRUCTION REQUIREMENTS

02000.3.1 PROJECT SIGN

The Contractor shall provide project signs, which includes furnishing all materials and labor to fabricate, deliver, install and maintain any and all project identification signs as detailed on Drawings and at location(s) shown thereon.

02000.3.2 VISUAL RECORDS

Prior to any disturbance of the area, the Contractor shall produce a DVD photography of all areas, including but not limited to right-of-ways, streets and roadways, haul-roads and access routes, storage areas, construction sites, and buildings or structures, which will be, or may be, affected by the Work. Such photography will be of a quality to allow accurate determination of location, size, and condition of existing features and improvements taken prior to any occupancy or execution of Work by the Contractor. Additionally, video for each street shall be separated into different chapters, which should each be accessible from the startup menu. Coverage should be taken while the camera is stationary, not from a moving vehicle or other means. DVD's are subject to approval by the engineer and owner. Construction may not begin until the engineer has approved the visual record.

02000.3.3 SERVICE CONNECTION LOCATION AND DOCUMENTATION

Unless called for differently, the Contractor shall contact and interview the owners of all properties indicated on the Drawings and obtain from them sufficient information for location of workable service connections for each property. The Contractor shall document those locations on the tie sheets and obtain a confirmation signature from the connection owner.

02000.4 METHOD OF MEASUREMENT

02000.4.1 MOBILIZATION

Mobilization shall be measured by the lump sum.

02000.4.2 PROJECT SIGN

Measurement for project signs shall be made by counting each sign installed and accepted.

02000.4.3 VISUAL RECORDS

Pre-Construction Photography shall be measured by the lump sum.

02000.4.4 SERVICE CONNECTION DOCUMENTATION

Service Connection Documentation shall be measured by the lump sum.

02000.5 BASIS OF PAYMENT

02000.5.1 The accepted quantity(s) shall be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Mobilization	Lump Sum
Project Sign	Each
Pre-Construction DVD	Lump Sum
Service Connection Documentation	Lump Sum

02000.5.2 PAYMENT SCHEDULE

The amount bid or identified in a schedule of values for Mobilization shall not exceed 10% of the total contract bid amount. The following payment schedule percentages shall be based on amount bid or identified in a schedule of values for Mobilization up to a maximum of 10% of the total contract bid.

Partial payments for Mobilization will be made in accordance with the payment schedule table below.

MOBILIZATION PAYMENT SCHEDULE

Payment	Amount	When Paid
1ST	25% of mobilization	With first partial payment after 3% of the original contract amount earned by the Contractor.
2ND	25% of mobilization	When amount earned by Contractor is 10% of the original contract price.
3RD	25% of mobilization	When amount earned by Contractor is 50% of the original contract price.
4TH (last)	25% of mobilization	When project is complete and accepted.

02005.1 DESCRIPTION

This section covers furnishing and maintaining all traffic control devices, flaggers and pilot vehicles necessary for protection of the Work, the workers and the traveling public in accordance with these Contract Documents. The requirements of this section are not intended to supersede, but shall supplement, the provisions contained in the "Manual of Uniform Traffic Control Devices" issued by the U.S. Department of Transportation, and any other applicable state or local traffic control regulations.

02005.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 01580 – Work Site Management
Section 02206 – Access Roads and Temporary Use of Roads

02005.1.2 SUBMITTALS

The Contractor, upon request of the Owner or Engineer, shall submit detailed traffic control plans for specific areas of the Work.

02005.1.3 DEFINITIONS

Traffic Control Devices - All temporary traffic control and warning devices required to warn traffic of, and to guide it through, construction areas as required under this Contract, including, but not limited to: portable cones and barricades, signs, channeling devices, paint striping, lighting devices, flags, etc.

Flaggers - Qualified and alert persons equipped with safety warning devices who direct traffic through construction areas.

Traffic Lane - Ten (10) feet of clear street width with a safe motor vehicle speed of twenty-five (25) miles per hour.

Pilot Car - Any designated and properly marked vehicle used for leading groups of vehicular traffic through construction areas.

02005.2 MATERIALS

Not Used.

02005.3 CONSTRUCTION REQUIREMENTS

02005.3.1 COORDINATION OF WORK AND TRAFFIC CONTROL

The Contractor shall endeavor to organize its work force in such a manner as to minimize the closure of public streets and roadways within the Work site. If conditions justify, the Engineer may direct the Contractor to conduct Work in specific areas and/or to specific tasks to avoid closure or interference with traffic on public streets and roadways.

02005.3.2 CLOSURE OF PUBLIC THOROUGHFARES

The Contractor shall not close any public street or roadway without prior approval by the Engineer. When closure is necessary, and approved, the street or roadway shall only be closed to through traffic and not to local traffic. Closure may extend for one city block only, or 700 feet,

whichever is less. Closure of streets and roadways shall be made with barricades meeting State DOT standards. Traffic shall be kept open on streets and roadways where no detour is possible.

02005.3.3 MAINTENANCE OF EXISTING SIGNS

Existing traffic signs other than stop, yield, and street name signs shall be maintained by the Contractor until such time as construction renders them obsolete. At that time the Contractor shall remove signs and posts without damage and deliver them as directed by the Engineer.

02005.3.4 PROTECTION OF WORK AND TRAFFIC

All obstructions and excavations, within traveled streets and roadways, shall be protected with traffic control devices meeting State DOT standards. Traffic control devices, placed within streets and roadways, shall be illuminated at night, and such illumination shall function from sunset to sunrise. Local jurisdiction may require traffic control measures greater than those of State DOT standards, in which case the Contractor shall comply with such requirements.

Whenever the Engineer finds traffic control conditions at the Work site to be inadequate to assure public safety, or the Contractor's protective facilities to be inadequate, the Engineer may require the Contractor to provide the additional necessary facilities or services. The Contractor shall bear the cost of the additional protection.

See also Subsection 01580.3.

02005.4 METHOD OF MEASUREMENT

02005.4.1 TRAFFIC CONTROL AS LUMP SUM

If traffic control appears as a separate item in the Bid Schedule, it shall be measured as a lump sum item. Therefore, with the possible exception of the items mentioned in the following two paragraphs, no separate measurement will be made for furnishing and maintaining traffic control devices, personnel, or any vehicles or other equipment used for traffic control.

02005.4.2 FLAGGING

When flagging is listed separately in the Bid Schedule, the work of flag persons will be measured by counting the number of hours put in by each separate flag person. This measurement shall include the time and/or mileage for any vehicle or other equipment required for performing the flagging work.

02005.4.3 PILOT VEHICLE

When a requirement for the use of pilot vehicles is called for separately in the Bid Schedule, that use will be measured by counting the number of hours each separate vehicle is in actual operation piloting or otherwise directing traffic.

02005.5 BASIS OF PAYMENT

02005.5.1 Unless provided for in the Contract Documents, the cost of all traffic control, including flagman, barricades, pilot cars and other devices, shall be included in the Contract Price and no separate measurement and payment will be provided.

02005.5.2 When provided in the Bid Schedule, the generally accepted quantities for traffic control shall be:

PAYMENT ITEM	UNIT
Traffic Control	Lump Sum
Flaggers	Hours
Pilot Vehicles	Hours

02015.1 DESCRIPTION

This section covers the removal of vegetation, debris, and other obstacles from the defined rights-of-way and limits of the project area and/or construction work site.

02015.1.2 RELATED WORK

Section 01510 - Protection of Existing Properties
Section 02200 - Trench Excavation and Backfill
Section 02500 - Removal and Replacement of Surface Improvements
Section 02900 - Landscaping

02015.1.3 DEFINITIONS

Clearing - consists of removal and disposal of trees, stumps, logs, limbs, sticks, vegetation, rubbish, debris and other material on the natural ground surface.

Grubbing - consists of removing and disposing of roots (one-inch and larger diameter), tree stumps, buried logs, debris, and other underground obstructions.

02015.2 MATERIALS

Not used

02015.3 CONSTRUCTION REQUIREMENTS

Clear, grub, remove and dispose of all trees, vegetation and debris within the staked limits of the roadways, trenches, channels, easements, embankments, structures, and other designated areas. Do not injure or damage trees, shrubs, or other vegetation and objects to remain intact as designated by the Engineer or the Owner. Such items are to be fully protected from injury at the Contractor's expense.

02015.3.1 CLEARING

Areas within the limits of excavation and embankment slope stakes shall be cleared.

Tree branches extending over the area to be cleared and which hang within 12 feet of the ground surface shall be cut off in a neat and workmanlike manner. When such branch removal is necessary, the Contractor shall remove other adjacent branches on the tree under the direction of the Engineer so as to present a balanced appearance. Scars resulting from the removal of branches shall be treated with a heavy coat of approved tree sealant.

02015.3.2 GRUBBING

Grub all areas within the limits described as follows:

02015.3.2.1 FOR CONSTRUCTION OF ROADWAYS - Grub the area between the limits of the excavation and embankment slope stakes to a depth of two (2) feet below natural ground level to remove all stumps, roots, buried logs and other underground debris. However, when the roadway embankment already is two feet or more above the natural ground level, stumps cut less than 6 inches above natural ground, together with roots and other non-perishable obstructions, may remain in place.

02015.3.2.2 FOR CONSTRUCTION OF PONDS OR LAGOONS AND STRUCTURES - completely grub the pond area within the boundaries of the dikes or structures to a depth of two (2) feet and remove all stumps, roots, buried logs and other underground debris. Grubbing of this area shall include removal of the top 6-inches of organic laden topsoil and stockpiling it for later distribution over areas shown in the Contract Documents or directed by the Engineer.

02015.3.3 BACKFILLING

All stump holes, cuts, depressions and other holes resulting from clearing and grubbing operations within areas designated to receive pipelines, structures, or embankments shall be backfilled and compacted to the density of the surrounding ground.

02015.3.4 DISPOSAL

The Contractor shall dispose of all materials resulting from clearing and grubbing operations as required in the Contract Documents and in accordance with Section 01520 of these Specifications.

02015.3.5 MARKERS, MONUMENTS AND DATA POINTS

Land monuments, property markers or official datum points shall be protected until their removal is approved. When movement of monuments or markers is deemed necessary and approved by the Engineer, all such monuments or markers shall be carefully referenced for re-establishment before removing.

02015.4 METHOD OF MEASUREMENT

02015.4.1 SEPARATE PAYMENT

Measurement for "Clear and Grub" shall be made either as lump sum or by counting the number of acres. to the nearest tenth (10^{th}), of area actually cleared and grubbed within the limits shown on the Drawings or as directed and approved by the Engineer. For areas where ponds or lagoons are to be constructed, this measurement shall include the removal and stockpiling of the first six (6) inches of topsoil in addition to grubbing to the required depths.

02015.4.2 NO MEASUREMENT

02015.4.2.1 NO PAY ITEM FOR CLEAR & GRUB - When the Bid Schedule does not contain a pay item for "Clear and Grub", then that work will be considered incidental to other Work items which require clearing and grubbing and no separate measurement shall be made.

02015.4.2.2 ROADWAY EXCAVATION and/or BORROW - Material used for filling depressions will be measured separately only when "Roadway Excavation" and/or "Borrow" appear as separate pay items on the Bid Schedule. Measurement will be made by counting the number of cubic yards of material moved and placed as designated on the Drawings or as directed and approved by the Engineer. If "Roadway Excavation" or "Borrow" are not included in the Bid Schedule, material used for filling depressions will not be measured separately, but will be considered incidental to the Work.

02015.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price.

PAYMENT ITEM	UNIT
Clear and Grub	Lump Sum
Clear and Grub	10^{th} of Acre

SPECIAL PROVISION

SUBSURFACE INVESTIGATION	SECTION SP02020

02020.1 DESCRIPTION

Furnish and provide labor and equipment for investigation of existing miscellaneous pipelines, wires or cables, and other miscellaneous sub-surface features as required by the Engineer.

02020.1.1 RELATED WORK

Section 01510 - Protection of Existing Improvements

02020.1.2 SUBMITTALS

Not used.

02020.1.3 DEFINITIIONS

Not used.

02020.2 MATERIALS

The Contractor shall provide a backhoe and qualified operator; laborer with hand shovel: appropriate fuel and lubricants, necessary equipment servicing materials; and appropriate equipment for transporting the backhoe to perform the investigation. The backhoe shall be a rubber tired CASE 580 backhoe, or an approved unit of equivalent or greater size and capacity, having accumulated not more than 5,000 hours operating time.

In the case of gas pipelines, petroleum pipelines, fiber communications, and waterlines the contractor shall utilize “hydrovac” equipment as the primary excavation method to locate the crossing pipeline.

02020.3 CONSTRUCTION REQUIREMENTS

02020.3.1 EXPOSURE BY EXCAVATION

The Contractor shall excavate, hydrovac and expose miscellaneous pipelines, structural features, soil materials and other underground features which may be present at the work site. The location and extent of exposure shall allow the Contractor to identify and bottom of the utility and survey elevations necessary to insure clearance between the 30-inch waterline and the intersecting utility or feature. Designation of such areas shall be made in writing, usually in the form of a Work Order, by the Engineer.

02020.3.2 REPLACEMENT OF EXCAVATED MATERIALS

Work required hereunder shall include replacement of excavated materials sufficiently to restore the site to a safe condition as determined by the utility owner and the Engineer. Full restoration of materials such as pavement, concrete slabwork, sod, etc., in the investigated area will be accomplished in accordance with the Contract Documents and as directed by the Engineer.

02020.4 METHOD OF MEASUREMENT

02020.4.1 MEASUREMENT

Measurement of subsurface investigation shall be made by the lump sum method to include the machine and operator to investigate miscellaneous underground features along the pipe alignment

as required. No allowance will be made for transporting the backhoe or hydro vac truck to and from the job site.

02020.4.2 MEASUREMENT FOR OTHER ITEMS OF WORK

When restoration of the excavated area requires provision of pavement, concrete slabwork, sod, etc., separate measurement will be made for those materials in accordance with the respective requirement(s) for measurement of that item in the Contract Documents.

02020.5 BASIS OF PAYMENT

The accepted quantity of work will be paid for at the contract unit price of:

PAYMENT ITEM	UNIT
Subsurface Investigation	Lump Sum

When provision of designated materials is required for restoration of the excavation, payment for such materials shall be made in accordance with the respective provisions of the Contract documents.

SPECIAL PROVISION

EARTHWORK MATERIALS	SECTION SP02105

02105.1 DESCRIPTION

This section covers obtaining permission, permits, clearances, etc.; as necessary to develop source(s), purchasing or manufacturing, loading, hauling, placing and compacting earthwork materials described herein, as shown on the Drawings and/or required by these Specifications.

02105.1.1 RELATED WORK

Section 02200 - Trench Excavation and Backfill

02105.1.2 SUBMITTALS

When the Bid Schedule indicates quantities of materials described in this section in excess of 50 cubic yards or 50 tons, or when requested otherwise by the Engineer, the Contractor shall provide test results from a certified independent laboratory which has sampled and performed the prescribed test(s) for those materials.

02105.1.3 DEFINITIONS

Granular Material - Material for which the sum of plasticity index (AASHTO T-90) and the percent of material passing a No. 200 sieve (AASHTO T-27) shall not exceed 23.

Silt - Material which passes the No. 200 (AASHTO T-11) sieve and has a plasticity index not greater than 10.

Clay - Material which passes the No. 200 sieve and has a plasticity index greater than 10.

Bedding - Materials placed immediately around and adjacent to pipe installed in trenches.

Borrow - Material obtained from a source away from the site on which installed and/or excavated and used to supplement insufficient quantities of material required.

02105.2 MATERIALS

02105.2.1 ON-SITE TRENCH OR STRUCTURAL BACKFILL

On-site trench or structural backfill consists of material excavated during trenching or foundation excavation which is free of cinders, ashes, wood, vegetation, frozen or other deleterious material or rocks with a maximum particle size not greater than 6-inches. Material may be required to be processed or transported along the excavation.

02105.2.2 IMPORTED TRENCH OR STRUCTURAL BACKFILL

Imported trench or structural backfill consists of granular material obtained from sources indicated on the Drawings, designated in the Special Provisions or approved by the Engineer. Borrow materials shall be free of cinders, ashes, wood, vegetative matter, frozen or other deleterious matter with a maximum particle size not greater than 6-inches. Pit Run Borrow may be used as backfill in trenches, excavations for structures, in roadway subgrades, or as otherwise shown on the plans or called for by the Engineer. Material may be processed or may be pit run.

02105.2.3 ON-SITE PIPE BEDDING

On-site pipe bedding consists of material excavated during the trenching operation which is free of cinders, ashes, wood, vegetation, frozen or other deleterious material or rocks with a maximum

particle size not greater than that shown below in Table 1a. Material may be required to be processed or transported along the trenching operation.

Table 1a - MAXIMUM PARTICLE SIZE FOR ON-SITE PIPE BEDDING

Pipe	Material Sieve Size % Passing
Corrugated Metal and Welded Steel Polyethylene, Galvanized Steel and PVC Ductile Iron, Cast Iron, Concrete, and HDPE	3/4" – 100% #200 – 0-20%

02105.2.4 IMPORTED PIPE BEDDING

Imported pipe bedding consists of granular material excavated from an approved borrow source which is free of cinders, ashes, wood, vegetation, frozen or other deleterious material or rocks with a maximum particle size not greater than that shown in Table 1b below. Material may be processed or may be pit run.

Table 1b - MAXIMUM PARTICLE SIZE FOR IMPORTED PIPE BEDDING

Pipe	Material Sieve Size % Passing
Corrugated Metal and Welded Steel Polyethylene, Galvanized Steel and PVC Ductile Iron, Cast Iron, Concrete, and HDPE	¾" – 100% #40 – 0-40% #200 – 0-13%

02105.2.5 SAND

Sand shall be graded granular material which passes a 3/8-inch sieve, with not more than 10 percent passing the No. 200 sieve (AASHTO T-27) and free from cinders, ashes, wood, vegetation, frozen or other deleterious material.

02105.2.6 UNTREATED BASE COURSE

Untreated base course consists of processed natural gravel and crushed rock with an approved soil binder without any deleterious materials, tested in accordance with AASHTO T-27 and T-11 which meets the gradation requirements in Table 2 below.

Table 2 - PARTICLE SIZE FOR UNTREATED BASE COURSE

Sieve Size	Percent Passing
1-inch	100
½-inch	70-90
#4	40-60
#16	20-40
#200	5-12

02105.2.7 BITUMINOUS SURFACING

Plant mix bituminous material, with maximum particle size not greater than 3/4-inch, meeting the requirements of Section 02511 of these Specifications.

02105.2.8 DRAIN GRAVEL

Drain gravel consists of washed natural gravel or crushed rock, with a maximum particle size of 1-inch, with not more than 40 percent passing the No. 4 sieve, with 100 percent being retained on the No. 10 sieve, and without any deleterious material.

02105.2.9 RIPRAP

Riprap consists of durable, angular, sound and hard field or quarry stones free from cracks and structural defects. Source of supply shall be approved by the Engineer. Fifty percent of the stones shall be of sizes between one-half and two-thirds of the riprap layer thickness shown on the Drawings. Not more then 10-percent of the stones by weight shall be of a size less than one-tenth of the riprap layer thickness shown on the Drawings and the specific gravity of the stones must range between 2.5 and 2.82 (AASHTO T-85). Durability of the stones shall be in excess of 40 percent (AASHTO T-210).

02105.2.10 SUBGRADE GRANULAR FILL

Subgrade granular fill consists of well graded granular soils with a maximum of 50 percent passing the No. 4 sieve and a maximum of 20 percent passing the No. 200 sieve and no materials greater than 4-inches in diameter.

02105.3 CONSTRUCTION REQUIREMENTS

02105.3.1 LOCAL GOVERNMENT SPECIFICATIONS

Differences may exist between the requirements of these Specifications for sitework materials such as backfill, bedding, untreated base course and bituminous surface course, and those of local government entities. Such differences may affect Contract prices; therefore, when Contract Work falls within the boundaries of any local government, the Contractor shall make himself aware of that entity's specifications for those materials. If differences exist between those specifications and these, unless otherwise approved by the Engineer, the more stringent ones shall apply.

02105.3.2 BORROW AND DISPOSAL SITES

The Contractor shall, at its own expense, secure all necessary access and borrow sites for acquisition or removal and to dispose of excess backfill or waste materials, unless otherwise shown on the Drawings.

02105.3.3 ON-SITE MATERIALS

Unless otherwise shown on the Drawings or directed by the Engineer, import pipe bedding and on-site trench backfill will be used for installation of all pipe. In areas where suitable on-site material is not available, other material, which meets these Specifications, will be used when shown on the Drawings, provided for in these Contract Documents or approved by the Engineer.

02105.3.4 SCALES

When ton weight is to be used to determine quantities of earthwork materials used, the Contractor shall provide his own scales or access to other scales at his own cost. Scales shall be certified accurate. Include certification in submittals.

02105.4 METHOD OF MEASUREMENT

02105.4.1 NO MEASUREMENT

On-Site Pipe Bedding and On-site Trench or Structural Backfill will be considered part of the items for piping or excavation associated with structures included in the Bid Schedule and no separate measurement for these materials will be made.

02105.4.2 SEPARATE MEASUREMENT

02105.4.2.1 IMPORTED MATERIALS – Quantities of imported pipe bedding and imported trench or structural backfill shall be determined by measuring the lineal feet (lineal feet of trench requiring imported materials) of imported material in place and accepted. This measurement shall include furnishing all necessary materials and equipment, labor, hauling, placement, compaction, and testing to produce an acceptable trench fill.

No allowance will be made for bedding and backfill materials required to fill voids caused by trenching operations, which exceed the dimensions shown on the Drawings.

02105.4.2.2 SAND – Quantities of sand shall be determined in cubic yards in place, calculated by multiplying the measured length of trench by the measured depth of bedding by the pay width shown on the Drawings, or as directed by the Engineer in the field.

No allowance will be made for materials required to fill voids caused by trenching operations, which exceed the dimensions shown on the Drawings.

02105.4.2.3 UNTREATED BASE COURSE - Quantities of untreated base course shall be determined in cubic yards in place, calculated by multiplying the measured length by neat line dimension shown on the drawings. If no neat lines are shown on the drawings, then the cubic yard calculations shall be determined by actual measurements in the field in place.

02105.4.2.4 BITUMINOUS SURFACING – Quantities of the respective compacted thickness of bituminous surfacing shall be determined in square yards by multiplying the length of material in place and accepted by the pay width shown on the Drawings, or as directed by the Engineer in the field.

02105.4.2.5 DRAIN GRAVEL - Quantities of drain gravel shall be determined in cubic yards calculated by multiplying the measured length by the measured depth of bedding in place by the pay width shown on the Drawings, or as directed by the Engineer in the field.

02105.4.2.6 RIPRAP - Quantities of riprap shall be determined in cubic yards by multiplying the measured length by the measured breadth by the measured average depth of material in place and accepted.

02105.4.2.7 SUBGRADE GRANULAR FILL - Quantities of subgrade granular fill shall be determined in cubic yards by multiplying the measured length by the measured breadth by the measured depth of material in place and accepted.

02105.5 BASIS OF PAYMENT

The accepted quantity shall be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Imported Trench or Structural Backfill	Lineal Foot
Imported Pipe Bedding	Lineal Foot

Sand	Cubic Yard
Untreated Base Course	Cubic Yard
Bituminous Surfacing (Thickness)	Square Yard
Drain Gravel	Cubic Yard
Riprap	Cubic Yard
Subgrade Granular Fill	Cubic Yard

SPECIAL PROVISION

TRENCH EXCAVATION AND BACKFILL — SECTION SP02200

Modify the following sections as shown.

02200.3.4 EXCAVATION IN ROCK

02200.3.4.1 SOLID ROCK EXCAVATION

Solid rock excavation will receive special consideration IF the following applies:

- The Contract Documents contain measurement and payment provisions for "Solid Rock Excavation", and
- Solid rock excavation is not included in another bid item, and
- Solid rock has been encountered in the excavation, and
- The Contractor has made ample (as determined by the Engineer) attempts to remove the rock using an excavator weighing not less than 74,000 lbs, such as a Cat 330B; then the excavation of such material will be considered as "solid rock excavation". As a general rule, if the specified excavator using a 30" bucket with rock teeth, requires more than two minutes to remove one (1) full bucket of material, the material is considered solid rock.

If the Contractor encounters solid rock (as described above) at a thickness greater than 12 inches, then the rock is considered "Solid Rock" and the Contractor will be reimbursed as outlined in the Measurement and Payment sections.

02200.3.5.3 UNSTABLE NATIVE FORMATIONS - The Contractor shall notify the Engineer if soft, spongy, or otherwise unstable native formations, that are not suitable for structure or pipeline foundations, are encountered in excavations. In the event the Engineer determines that the existing foundation materials are unacceptable, the Contractor will be directed to over-excavate, remove and replace the unsuitable soil materials in accordance with the "Weak Soils Crossing" detail in the plans.. The over-excavation shall be lined with the detailed geotextile fabric and backfilled with approved select materials and compacted in accordance with the requirements described herein. Such situation will not be considered as a changed condition, and the Contractor will be compensated in accordance with the bid item on the per lineal foot basis.

02200.3.13 BEDDING AND PIPELINES

02200.3.13.1 USE OF ON-SITE MATERIALS - On-site materials complying with Section SP02105 may be used for bedding if the contractor demonstrates by sieve analysis that the requirements can be met.. Due to the possibility that on-site materials may not comply with Section SP02105, the project bid schedule has provided for import bedding that will be required in the event on-site materials do not meet SP02105..

02200.3.13.2 INSUFFICIENT ON-SITE MATERIALS – The contract documents provide for imported pipe bedding. No change will be negotiated to provide bedding meeting the requirements of Section SP02105.

02200.4.2 SPECIFIED SOLID ROCK MEASUREMENT

When listed as a separate item in the bid schedule, quantities of solid rock excavation shall be determined by the cubic yard (in situ), using a tape measure or other accurate measuring device to find the length and height of cut in lineal feet along the plane of cut multiplied by the width of the trench. This measurement shall include all labor, equipment, materials, and related work, including, but not limited to, ripping, sawing, boring, hammering, blasting, rock trenching,

excavating, removing, hauling, and disposal, if required, of the existing bedrock deemed qualified by the Engineer for payment of completed rock excavation.

02200.5 BASIS OF PAYMENT

Separate payment will not be made for trench excavation unless prescribed otherwise in the Contract Documents. Solid rock Excavation and Weak Soils Crossings shall be paid at the following units.

PAYMENT ITEM	UNIT
Solid Rock Excavation	Cubic Yard (in situ)
Weak Soils Crossing	Lineal Foot

02201.1 DESCRIPTION

This section covers furnishing all equipment, labor, and other facilities to excavate, remove, backfill, compact, grade and shape earth materials required for construction of buildings, bridges, retaining walls, head walls, box culverts and other structures, in accordance with the Contract Documents.

02201.1.1 RELATED WORK

Section 01510 - Protection of Existing Properties
Section 02015 - Clearing and Grubbing
Section 02105 - Earthwork Materials
Section 02500 - Removal and Replacement of Surface Improvements
Section 02900 - Landscaping

02201.1.2 SUBMITTALS

Not used.

02201.1.3 DEFINITIONS

Consolidated Backfill - A condition of backfilling for which a specified compaction density is required. Maximum allowable lifts for consolidated backfill under this Section shall be 8 inches unless otherwise approved by the Engineer.

Unconsolidated Backfill - A condition of backfilling for which no compaction density is specified and the required compaction effort is layer placing and then compacting by wheel rolling or use of compacting equipment. Lifts of up to 24 inches are allowed for unconsolidated backfill.

Unclassified Excavation - A determination for excavating whereby no consideration will be given to different kinds of materials that are encountered.

Embankment Fill - The placement and compaction of suitable materials to raise the existing grade to the established elevations, and the placement and compaction of suitable materials within areas where unsuitable materials have been removed. Maximum lift for embankment fill under this Section shall be 6 inches unless otherwise approved by the Engineer.

02201.2 MATERIALS

Not used

02201.3 CONSTRUCTION REQUIREMENTS

02201.3.1 PERMITS

For work within state or federal highway rights-of-way, the Contractor shall be responsible for obtaining all required encroachment and construction permits prior to beginning any work within the rights-of-way.

02201.3.2 SITE PREPARATION

02201.3.2.1 CLEARING THE SURFACE - Before proceeding with any ground surface disturbances for work under this Section, the area to be disturbed by excavation, grading or embankments shall be cleared and grubbed in accordance with Section 02015.

02201.3.2.2 TOPSOIL - Unless otherwise indicated, the Contractor will not be required to separate, stockpile and replace topsoil on the Work site. When required in the Contract Documents, topsoil shall be removed and stockpiled for later distribution in accordance with Section 02015.

02201.3.2.3 REMOVAL OF SUBSURFACE MATERIALS - Following completion of clearing and grubbing, the Contractor shall locate and remove existing underground debris, posts, piping, cables and other underground obstructions. Unless indicated otherwise in the Contract Documents, no separate allowance for costs associated with removal of these materials will be allowed to the Contractor.

02201.3.2.4 RELOCATION OF UNDERGROUND UTILITIES - When required by the Contract Documents or determined necessary by the Engineer, existing underground utilities or other objects shall be relocated to provide clearance for required structural components prior to starting any structural excavation.

02201.3.3 EXCAVATION

02201.3.3.1 UNCLASSIFIED EXCAVATION - All excavation shall be unclassified, unless otherwise indicated in the Contract Documents. The Contractor shall perform all excavation to the elevations and dimensions shown on the Drawings and/or as required to accomplish the Work.

02201.3.3.2 CUT SLOPES - Unless otherwise shown on the Drawings, or directed by the Engineer, cut and fill slopes, or cut slopes in soil, shall be no steeper than two horizontal to one vertical. Cut slopes in rock shall be no steeper than 1.5 horizontal to one vertical.

02201.3.3.3 STOCKPILING AND DISPOSAL OF EXCAVATED MATERIALS - During the excavation operations, excavated materials which are suitable for use as backfill or embankments around structures, shall be piled separately at sufficient distance from the opening to be out of the way of equipment and to prevent slides or cave-ins.

All excavated materials not suitable, or not required, for fill or backfill shall be removed promptly from the site of the Work and disposed of in accordance with Section 01520.

Excavated materials, regardless of their disposition, shall be piled in such manner that will cause the minimum of inconvenience to public travel, and provisions shall be made for emergency travel as necessary.

02201.3.3.4 SHORING AND BRACING - Shoring or bracing shall be provided in accordance with OSHA safety requirements on all excavations, to protect workmen and the progression of the Work. In addition, excavation walls shall be braced and supported as required to prevent ground collapse or movement of ground surfaces and structures adjacent to the excavation. Slides or settlements, which occur in the excavation, shall be promptly removed and corrected by the Contractor. The arrangement of shoring and bracing components shall be made so as not to place any stress on portions of completed work.

02201.3.4 EXCAVATION IN ROCK

02201.3.4.1 SOLID ROCK EXCAVATION - Demonstration of the presence of "solid rock excavation" may constitute a changed condition, and the Contractor will be compensated for removal of such material in accordance with the General Conditions. Before excavation will be considered as "solid rock excavation", the Contractor shall demonstrate an inability to remove rock by making three attempts to rip the rock using equipment having not less than 235 fly wheel horsepower with a "Kelly" or similar type ripper. After such demonstration has indicated the presence of solid rock, and the Engineer determines its removal is necessary, authorization for removal of the solid rock may be granted in accordance with Section 00700.13 of the General Conditions.

02201.3.4.2 BLASTING - When blasting is deemed necessary for rock removal, the Contractor shall comply with all applicable State and Local laws, ordinances, and provisions for blasting safety and obtain written approval from the Engineer prior to starting of drilling and/or blasting operations.

In all cases, blasting shall be performed by experienced, qualified blasters. The Contractor is responsible for any and all damage caused by blasting, and blasting will not be allowed within 15 feet of any existing structures.

02201.3.5 OVER-EXCAVATION

02201.3.5.1 UNAUTHORIZED OVER-EXCAVATION - Care shall be taken not to excavate below the depth required by the Drawings. Any unauthorized over-excavation shall be refilled and compacted with material meeting the requirements of Section 02105 and approved for use by the Engineer at the expense of Contractor.

02201.3.5.2 UNSTABLE NATIVE FORMATIONS - The Contractor shall notify the Engineer if soft, spongy, or otherwise unstable native formations, unsuitable for structure foundations, are encountered during excavation. In the event the Engineer determines that such formations are inadequate, the Contractor will be directed to over-excavate and remove the unsuitable materials. The over-excavation shall be backfilled with approved select materials and compacted in accordance with the requirements described herein. Such situation will be considered as a changed condition and the Contractor will be compensated in accordance with the General Conditions.

02201.3.6 WATER

02201.3.6.1 DEWATERING - The Contractor shall control all ground or surface water during excavation, grading and subsequent construction activities. Dewatering systems shall be provided and operated by the Contractor so as to prevent the removal of the natural soils. Grading shall be performed as necessary to prevent surface water from flowing into excavations. Any water accumulated, therein during construction, shall be promptly removed by pumping or by other approved methods at the Contractor's expense.

Dewatering efforts shall be sufficient to ensure that softening of the bottom of excavations or formation of "quick" conditions or "boils" shall be prevented. Natural or compacted materials within the excavated areas, softened by saturation with ground water or standing surface water, shall be removed and replaced as instructed by the Engineer, at no additional cost to the Owner.

02201.3.6.2 INSTALLATION IN WATER - No backfill, subgrade materials, concrete or masonry footings, foundations, floors, equipment, or pipe shall be placed or laid in water. Water shall not be allowed to rise over such work for at least 24 hours following the pour or placement of any concrete or mortar used in the Work. Water shall not be allowed to rise unequally against structure walls for a period of 14 days following concrete placement or masonry erection.

02201.3.6.3 DISPOSAL - Any water to be removed from the Work site shall be disposed of by the Contractor in a suitable manner without damage to adjacent property.

02201.3.6.4 REFERENCE - See also Section 02200.3.12.

02201.3.7 SCARIFICATION

After excavating to the lowest subgrade elevation shown on the Drawings, and prior to placement of the structure footings or foundation components, unless otherwise directed by the Engineer, the top 6 inches of the subgrade shall be scarified, brought to the proper moisture content, and compacted in accordance with the Table of Minimum Density Requirements below.

02201.3.8 EMBANKMENT FILL AND BACKFILL

02201.3.8.1 ON-SITE BACKFILL MATERIALS - Unless directed otherwise by the Engineer or the Contract Documents, on-site materials complying with Section 02105 shall be used for all embankment, fill and backfill materials. Before on-site material becomes unavailable, and when provisions are not included in the Contract Documents for importing suitable materials, the Contractor shall notify the Engineer so that a change can be negotiated in accordance with the General Conditions.

02201.3.8.2 PLACEMENT IN LIFTS - Unless provided otherwise on the Drawings, suitable embankment fill, backfill, and bedding materials shall be placed in lifts which will be not greater than 6 inches thick after compaction. Bedding materials shall be moisture conditioned (by wetting or drying), before being placed in layers for compaction in accordance with the requirements of the Table of Minimum Density Requirements below.

02201.3.8.3 UNSUITABLE FILL AND BACKFILL MATERIALS - Any unsuitable fill and/or backfill material found within excavated materials, or material with incorrect moisture content shall be removed and replaced. Soft spongy material, causing areas that "pump" when heavy loads are passed over them, shall be removed and replaced with suitable material. Dry material that will not "ball" shall be removed and replaced. The two foregoing conditions shall be considered sufficient evidence, without further testing, that the moisture content is incorrect and shall be grounds for removal and replacement of the material. Such replacement if required shall be at the sole expense of the Contractor, and shall be accomplished prior to placement of any further material.

02201.3.9 COMPACTION

02201.3.9.1 MININUM DENSITY REQUIREMENTS - After placement, all materials shall be thoroughly compacted to not less than the densities indicated in the table below. Compaction shall be achieved and verified in accordance with AASHTO T-99, ASTM D-1556, ASTM D-1557, ASTM D-2922 and/or ASTM D-3017 as applicable.

TABLE OF MINIMUM DENSITY REQUIREMENTS
(based on AASHTO-99 and T-91 and on ASTM D-2922 and E-3017)

Location	From Surface to 2-Feet Below Surface	From 2-Feet Below Surface to Top of Bedding	Bedding
Within 6 feet of, and/or under, any existing or proposed structure, pavement, curb, sidewalk or similar construction included in the Contract:	100% for granular and 95% for non-granular materials	95% for all materials	95% at all locations
Around any structure outside 6 feet:	90% for all materials	90% for all materials	90% at all locations
Cultivated and landscaped areas:	85% for all materials	85% for all materials	85% at all locations
Undeveloped land:	Unconsolidated - see 02201.1.3	Unconsolidated - see 02201.1.3	85% at all locations

02201.3.9.2 OTHER SPECIFICATIONS - For work within state or federal highway rights-of-way, compaction shall meet the requirements of the respective applicable specifications.

02201.3.9.3 COMPACTION EQUIPMENT - Embankment fill and consolidated backfill material shall be compacted with conventional tamping or vibrating compaction equipment of such capacity and weight to achieve the required compaction density. The use of wheel rolling for compaction shall only be approved for compacting unconsolidated backfill materials.

02201.3.9.4 PLACEMENT AGAINST STRUCTURES - Embankment fill or backfilling against cast-in-place concrete structures shall not be started until the concrete has been cured for the time required by these Specifications or prescribed by the Engineer. Compaction within 3 feet of any new or existing structure shall be by hand operated vibratory or tamping equipment.

02201.3.9.5 CONSTRUCTION WATER - The Contractor shall be responsible for obtaining construction water needed for compaction in accordance with Section 02204.

02201.3.10 SETTLING AND SUBSIDENCE

Dips or settlement of fill or backfill in any excavation or embankment within the Work, which occur within the warranty period, shall be repaired by the Contractor at no additional cost to the Owner.

02201.3.11 SAMPLING AND TESTING

02201.3.11.1 INDEPENDENT LABORATORY - The Contractor shall provide all required sampling and testing by an independent qualified testing laboratory as directed by the Engineer.

02201.3.11.2 SCHEDULE OF SAMPLING AND TESTING - The following schedule of sampling and testing provides minimum requirements, to assure compliance with all materials and compaction requirements described herein. The number of samples and tests shown shall be considered minimum, and field conditions may necessitate additional sampling and testing to be required by the Engineer.

GRADATION DETERMINATION (AASHTO T-27 and T-11)

Location	Testing Required
Materials imported or manufactured at a site determined by this contract	One test per site or source
On-site excavated materials along trenches	One test per geographical area where material composition and gradation visually appears consistent.

MOISTURE/DENSITY RELATIONSHIP (Proctor)
(AASHTO T-99 or T-180 Method D)

Location	Testing Required
Materials imported or manufactured at a site determined by this Contract.	One test per site unless the material visually appears to change.
On-site excavated materials along trenches.	One test per geographical area where material composition visually appears consistent.

COMPACTION COMPLIANCE TESTING REQUIREMENTS
(AASHTO T-191 or Portable Nuclear Gauges)

Location	Testing Required
Under Structure footing or foundation	One test per lift for each 100 linear feet.
Within an embankment erected to support a structure under structure floor slabs	One test per lift for each 1,000 square feet.
Within embankments for cultivated or landscaped areas.	One test per lift for each 5,000 square feet.

NOTE: The term "test" shall mean a single test with acceptable results, equal to or better than specified minimums. In the event compaction test results fall below the required minimum density; the Contractor shall re-compact and test the material until a test with acceptable results is obtained.

02201.3.12 GRADING

Upon completion of excavation, the site shall be accurately graded to the spot elevations and slopes shown on the Drawings, to allow proper installation of the structure in accordance with applicable Sections of these Specifications.

02201.4 METHOD OF MEASUREMENT

02201.4.1 NO MEASUREMENT

Separate measurement will not be made for earthwork for structures. Unless the Contract Documents contain provisions for "Solid Rock Excavation", no separate measurement or payment will be made for work requiring rock excavation.

02201.4.2 SEPARATE MEASUREMENT

When listed as a separate item in the Bid Schedule, quantities of solid rock excavation shall be determined by the foot/foot unit, using a tape measure or other accurate measuring device to find the length of cut in lineal feet along the plane of cut and the average depth of cut in the rock and multiplying the two numbers together. This measurement shall include all labor, equipment, materials, and related work, including, but not limited to, ripping, sawing, boring, hammering, blasting, rock trenching, excavating, removing, hauling, and disposal, if required, of the existing bedrock deemed qualified by the Engineer for payment of completed rock excavation.

02201.5 BASIS OF PAYMENT

Payment for earthwork for structures shall be included in the unit prices provided for the respective structure elements listed in the Bid Schedule. When listed as a separate item on the Bid Schedule, payment for "Solid Rock Excavation" will be made as follows:

PAYMENT ITEM	UNIT
Solid Rock Excavation	Foot/Foot

02202.1 DESCRIPTION

This section covers construction of roadways and embankments, roadway ditches, channel changes, furrows, slope rounding, benches, berms, dips, approaches, and subsidiary work.

02202.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 02208 – Flowable Backfill (required during winter months)

02202.1.2 SUBMITTALS

Not used.

02202.1.3 DEFINITIONS

Roadway - The graded portion of a road within the top of cut slopes and the toe of embankment slopes, excavated and placed to form a surface for vehicular travel.

Excavation - That portion of the roadway which is removed from its original position and deposited within the roadway as embankment.

Embankment - Excavated earth materials moved from an original source and placed within the roadway.

Unsuitable Material - Excavated earth materials determined by the Engineer to be unsuitable for placement in roadway embankment. Such materials may include rock too large for placement in embankment, topsoil containing excessive vegetative debris, unstable earth materials, etc.

Roadbed - That portion of the roadway graded to the surface upon which vehicles travel, including the shoulders.

Subgrade - The graded roadbed finished according to the details shown on the Drawings and prepared to receive surfacing when called for on the Drawings.

Borrow - Earth materials excavated from a designated source, outside the roadway, and placed in embankments within the roadway. Designated sources for borrow material shall be shown on the Drawings or elsewhere described in the Contract Documents, and shall be approved by the Engineer prior to being place in embankment.

Pioneering - The beginning or opening of a route on which a roadway is to be constructed prior to clearing or starting any earthwork excavation.

Structure Excavation - Excavation, backfill and/or disposal of material required in the roadway for construction of culverts, bridge foundations or other structures.

Cushion - Soil materials placed over rocks or solid rock portions of the roadway to provide a gradable surface. Cushion materials shall not contain rocks large than one-third of the minimum thickness of the cushion layer.

02202.2 MATERIALS

Not used.

02202.3 CONSTRUCTION REQUIREMENTS

This Work shall consist of furnishing all labor, equipment and materials for constructing a roadway, including borrow excavation, drainage excavation, removal of slide material, excavation of unsuitable material, embankment construction and disposal of all excavated material necessary for the completion of construction.

02202.3.1 CLEARING AND GRUBBING

Clearing and grubbing shall be accomplished in accordance with Section 02015 before any excavation or embankment begins, except that grubbing of stumps when approved by the Engineer may proceed concurrently with excavation, and the removal or burning of cleared debris may be delayed until weather permits. Excavation and placement operations shall be conducted so material to be treated under Section 02015 will not be incorporated in the roadway.

02202.3.2 PIONEERING

Pioneering operations for the top of excavation slopes, toe of embankments, or pioneer road construction shall be accomplished to prevent undercutting of the final excavation slope, depositing of materials outside of the roadway limits and any restriction of drainage.

02202.3.3 UTILIZATION OF EXCAVATED MATERIALS

All suitable excavated material shall be used in the construction of embankments, subgrades, shoulders, slopes, bedding and backfill for structures and for other purposes as shown on the Drawings and as described below:

02202.3.3.1 EXCESS EXCAVATION - Designed excess excavation shall be disposed of as shown on the Drawings.

02202.3.3.2 ROCK FOR SLOPE PROTECTION - When approved by the Engineer, excavated rock suitable for protection of embankments may be conserved and used in lieu of a designated materials source.

02202.3.3.3 CONSERVING MATERIAL - Material encountered in the excavation, suitable for cushion, road finishing or other purposes, may be conserved and utilized instead of materials from designated sources.

02202.3.3.4 EXCAVATION OF UNSUITABLE MATERIAL - Unsuitable material shall be excavated. Disposal will be as shown on the Drawings. Excavated areas shall be backfilled with suitable material when necessary to complete the Work. Frozen material shall not be placed in embankments. Rocks that are too large to be incorporated into the embankment shall be broken for incorporation into the embankment or maneuvered to the face of the embankment and embedded so that they will not roll or obstruct the use and maintenance of the roadbed, or moved to locations approved by the Engineer.

02202.3.3.5 CONSERVATION OF TOPSOIL - When indicated on the Drawings, suitable topsoil shall be removed, transported, and deposited in the designated stockpile areas.

02202.3.3.6 ABANDONED STRUCTURES AND OBSTRUCTIONS - Abandoned structures and obstructions shall be treated in accordance with Section 02500.

02202.3.4 DRAINAGE EXCAVATION

Drainage excavation shall include construction of side ditches, minor channel changes, inlet and outlet ditches, furrow ditches, ditches constructed along the road but beyond the roadway limits and

other minor earth drainage structures as shown on the Drawings. Excavated material shall be utilized in accordance with subsection 02202.3.3 above.

02202.3.5 FINISHING ROADBED

02202.3.5.1 OVERSIZE MATERIALS - For roads receiving aggregate base or surface course, only rocks that do not protrude above the subgrade more than one-third of the depth of the base or surface course or 3-inches, whichever is less, may remain in place.

For unsurfaced roads, unless otherwise shown on the Drawings, the top 4-inches below the finished road surface shall not contain rocks larger than 4-inches in greatest dimension. Oversize material shall be removed, reduced to acceptable size or covered by importing suitable material approved by the Engineer.

02202.3.5.2 SHAPING AND DRESSING - The subgrade shall be visibly moist during shaping and dressing. Low sections, holes, cracks or depressions shall be brought to grade with suitable material approved by the Engineer. Final compaction of the subgrade shall meet the requirements of the embankment placing method specified.

02202.3.6 SNOW REMOVAL

Snow and/or ice shall not be incorporated into the embankment. Snow shall be removed in advance of the work to be performed and shall be deposited beyond the roadway limits in a manner that will not result in erosion or waste material.

02202.3.7 FINISHING SLOPES

02202.3.7.1 SLOPE SURFACE - Slopes shall be finished as closely as is practicable to the lines staked on the ground or shown on the Drawings. The finished slope shall be left in a slightly roughened condition to facilitate the establishment of vegetative growth. The finish associated with template and stringline or hand-raking methods will not be allowed. Loose rock, loose debris and other loose material, each of which is large than 6-inches in diameter, shall be removed from the slope unless otherwise shown on the Drawings.

02202.3.7.2 SLOPE TOP - The tops of excavations, excluding areas of solid rock, shall be blended with the adjacent terrain by rounding when shown on the Drawings. Decomposed rock that may be cut without blasting or ripping shall be rounded. Earth overlying rock shall be rounded above the rock.

02202.3.8 BLASTING

02202.3.8.1 CONTROLLED BLASTING - All rock excavations that require blasting shall be formed with controlled blasting techniques unless otherwise shown on the Drawings. Controlled blasting is defined as the controlled usage of explosives and blasting accessories in appropriately aligned and spaced drill holes for the purpose of producing a free surface or shear plane in the rock excavation slopes and of minimizing landscape damage, adjacent ground vibration and overbreak. Presplitting is not intended unless shown on the Drawings and described in the Contract Documents.

02202.3.8.2 TEST SECTIONS - Unless directed otherwise by the Engineer, the Contractor shall drill, blast and excavate short test sections (not to yield in excess of 1,000 cubic yards) to determine the controlled blasting method, hole spacing and charge best suited to the material encountered.

02202.3.9 OVERBUILDING

Unless otherwise agreed to by the Engineer, excavation or embankment material shall be confined within the roadway limits to avoid overbuilding and to protect the adjacent property.

02202.3.10 SUBGRADE TREATMENT

02202.3.10.1 TREATMENT MATERIALS - Subgrade treatment shall consist of soil modification by mixing aggregates, placing geotextiles, fiber mat, rock blanket or other similar materials over areas of unsuitable embankment foundation material that will be indicated on the Drawings. The construction and material requirements for the subgrade treatment will be specified in the Contract Documents.

02202.3.10.2 SWAMPY GROUND - When an embankment is to be placed across swampy ground and removal of unsuitable material or subgrade treatment is not required, the lower part of the embankment may be constructed in a single layer to the minimum depth necessary to support construction equipment.

02202.3.11 EMBANKMENT PLACEMENT

All embankments shall be placed by one or more of the following methods as shown on the Drawings and listed in the Bid Schedule.

02202.3.11.1 METHOD 1 - SIDE CASTING AND END DUMPING - Embankment may be placed by side casting and end dumping. Where material containing a large amount of rock is used to construct embankments, a solid embankment shall be provided by working smaller rocks and fines in with the large rocks and fines to fill the voids.

02202.3.11.2 METHOD 2 - LAYER PLACEMENT - Surfaces steeper than a ratio of 3 horizontal to 1 vertical (3:1) upon which embankment is to be placed, shall be roughened or stepped when shown on the Drawings to provide permanent bonding of new and old materials.

- Embankment shall be layer placed, except over rock surfaces, in which case material may be placed by end-dumping to the minimum depth needed for operation of spreading equipment. Each embankment layer shall be leveled and smoothed before placement of subsequent layers. Hauling and spreading equipment shall be operated uniformly over the full width of each layer.

- Suitable material shall be placed in layers no more than 12-inches thick, except when the material contains rock more than 9-inches in diameter, in which case layers may be of sufficient thickness to accommodate the material involved. No layer shall exceed 24-inches before compaction.

- Placing individual rocks or boulders greater than 24-inches will be permitted provided the embankment will accommodate them. Such rocks and boulders shall be at least 6-inches below subgrade. They shall be carefully distributed and the voids filled with finer material to form a dense and compacted mass.

- Where material containing large amounts of rock is used to construct embankments, the layers may be of sufficient thickness to accommodate the material involved. A solid embankment with adequate compaction shall be constructed by working smaller rock and fines in with the larger rocks to fill the voids and by operating hauling and spreading equipment uniformly over the full width of each layer as the embankment is constructed.

- Material shall be at a moisture content suitable to obtain a mass that will not visibly deflect under the load of the hauling and spreading equipment. Excessively wet excavated material shall be handled in accordance with Subsection 02202.3.3.1.

02202.3.11.3 METHOD 3 - LAYER PLACEMENT (ROLLER COMPACTION) - Embankments shall be placed as specified in Method 2. Placement shall be in horizontal layers not exceeding 12-inches prior to compaction, except when the material contains rock more than 9-inches in diameter, in which case layers may be of sufficient thickness to accommodate the material involved. Compaction shall be

obtained with equipment in compliance with the requirements described in the Specifications. Compaction equipment shall be operated over the full width of each layer until visible deformation of the layer ceases or, in the case of the sheepsfoot roller, the roller "walks out" of the layer. At least three complete passes will be made.

02202.3.11.4 METHOD 4 - CONTROLLED COMPACTION - Embankments shall be placed as specified in Method 2 except earth embankments shall be placed in horizontal layers not exceeding 12-inches (loose measure) and compacted. Material shall be at a moisture content suitable for attaining the required compaction. Embankments and the top 1-foot of excavation sections shall be compacted to at least 95 percent of the maximum density as determined by AASHTO T 180, Method C or D.

- The density of the embankment material shall be determined during the progress of the Work in accordance with AASHTO T 191, T 205 or T 238; T 217, T 239 or T 255; and T 224.

- Density requirements will not apply to portions of rock embankments that cannot be tested in accordance with approved methods. When this condition exists, compaction shall be provided by working smaller rocks and fines in with the larger rocks to fill the voids and by operating equipment over the embankment materials.

02202.3.12 COMPACTION EQUIPMENT

02202.3.12.1 EQUIPMENT - Compaction equipment shall be capable of obtaining compaction requirements without detrimentally affecting the compacted material. The compacting units may be any one of the types described herein, provided they are capable of compacting each lift of material as specified and meet the minimum requirements contained herein.

02202.3.12.2 ROLLER REQUIREMENT - Minimum requirements for rollers are as follows:

- Sheepsfoot, tamping or grid rollers shall be capable of exerting a force of 250 pounds per inch of width of roller drum.

- Steel-wheel rollers, other than vibratory, shall be capable of exerting a force of not less than 250 pounds per inch of width of the compression roll or rolls.

- Vibratory steel-wheel rollers shall have a minimum weight of 6 tons. The compactor shall be equipped with amplitude and frequency controls and specifically designed to compact the material on which it is used.

- Pneumatic-tire rollers shall have smooth tread tires of equal size that will provide a uniform compacting pressure for the full width of the roller and capable of exerting a ground pressure of at least 80 psi.

02202.3.13 CONSTRUCTION TOLERANCES

Unless provided otherwise herein, a specific tolerance class for allowable deviation from construction stakes and Drawings shall be shown on the Drawings. A Table of Tolerance is provided below:

TABLE OF TOLERANCES

MEASUREMENT	TOLERANCE CLASS		
	A	B	C
Roadbed Width	+0.5	+1.0	+2.0
(feet) Subgrade Elevation	±0.1	±0.2	±0.5
(feet) Centerline Alignment	±0.2	±0.5	1.0

Deviations shall be uniformly graded in the direction of change for a distance of 200-feet or more along the roadway. Roadway ditches shall always be constructed to flow in the direction shown on the Drawings, regardless of allowable deviations. Roadbed width shall be no less than the dimension shown on the Drawings or staked in the field. When a tolerance class is not otherwise indicated on the Drawings, Class B tolerance deviations will be allowed for roadway construction.

02202.3.14 WATER

Water provided for compaction, dust control, or planting and care of vegetation, shall be developed, hauled and applied in accordance with Section 02204.

02202.4 METHOD OF MEASUREMENT

02202.4.1 ROADWAY EXCAVATION

02202.4.1.1 SEPARATE MEASUREMENT - When shown as a separate item on the Bid Schedule, quantities of roadway excavation, in cubic yards, shall be determined, for undisturbed material in its original position on the ground, as measured by slope staking performed before the start of construction. Unless shown otherwise herein, measurement for roadway excavation shall include the following:

- All loosening, loading, transportation, spreading, compaction and grading required to achieve the staked grades and alignment.
- Material excavated below the required grade and beneath embankment areas when shown on the Drawings or directed by the Engineer.
- Ditches located outside of the roadway, except when they are included as an item on the Bid Schedule.
- Topsoil or other material removed and stockpiled as directed, when not measured as a separate pay item.
- Borrow material used in the Work, except when borrow is included in the Bid Schedule.
- Slide material not attributable to the negligence of the Contractor.
- The volume of materials taken from stockpiles and used in the Work, except materials included in other pay items.

02202.4.1.2 NO MEASUREMENT - Measurement for roadway excavation shall not include the following:

- Material used for other than approved purposes.
- Unauthorized excavation or borrow.
- Quantity of material excavated from slope rounding.
- Overbreakage from the backslope in rock excavation requiring blasting.
- Material scarified in place to receive the first layer of embankment.
- Benching or stepping existing ground for embankment foundation.
- Stepping or scaling cut slopes.

- Oversize material removed when finishing unsurfaced roads.

02202.4.2 ROADWAY EMBANKMENT

When shown as a separate item in the Bid Schedule, measurement of quantities for roadway embankment will be by the cubic yard as determined from slope stake information taken prior to construction, for materials in place, compacted, and accepted.. Unless shown otherwise herein, measurement shall include all loosening, loading, transportation spreading, compaction and grading required to achieve the staked grades and alignments.

02202.4.3 ROADWAY BORROW

When shown as a separate item in the Bid Schedule, quantities for roadway borrow, calculated in cubic yards, shall be measured by. comparing preliminary cross-sections of the material on the undisturbed ground to other cross sections taken following its removal. Measurement shall include all loosening, loading and transportation to the location of the embankment designated for deposit.

02202.4.4 WATER

02202.4.4.1 NO SEPARATE MEASUREMENT - Unless shown as a separate item in the Bid Schedule, no separate measurement shall be made for water required for compaction, handling or other purposes associated with earthwork excavation and embankment.

02202.4.4.2 SEPARATE MEASUREMENT - When included as a separate item, measurement will be made in accordance with Section 02204.

02202.4.5 TOPSOIL

When topsoil stripping and stockpiling is included as a separate item in the Bid Schedule, measurement will be by the cubic yard placed in stockpiles at designated locations shown on the Drawings or directed by the Engineer. Measurement shall include loading, transportation and placement into stockpiles at designated locations.

02202.4.6 TOPSOIL SPREADING

When topsoil spreading is included as a separate item in the Bid Schedule, measurement will be by the square yard of surface on which the material is spread at a depth indicated in the Drawings. Such measurement shall include loading from a stockpile or designated source, transporting and spreading to the required depth.

02202.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
Roadway Excavation (Placement Method)	Cubic Yard
Roadway Borrow (Placement Method)	Cubic Yard
Roadway Embankment (Placement Method)	Cubic Yard
Subgrade Treatment (Type)	Square Yard
Drainage Excavation (Type)	Lineal Foot
Drainage Excavation (Type)	Cubic Yard
Topsoil (Stripped & Stockpiled)	Cubic Yard
Topsoil (Spread)	Square Yard

SPECIAL PROVISION

WATER FOR CONSTRUCTION — SECTION SP02204

02204.1 DESCRIPTION

Furnish and apply water for: dust control, pre-wetting, mixing or compacting earth materials for road, site, and/or trench construction, and for other needs associated with the Work.

02204.1.1 RELATED WORK

Not used.

02204.1.2 SUBMITTALS

Not used.

02204.1.3 DEFINITIONS

Not used.

02204.2 MATERIALS

Water shall be free of dirt and silt or any substances injurious to plant life. A separate supply of potable water shall be provided for drinking when it becomes necessary to provide water for workers.

02204.3 CONSTRUCTION REQUIREMENTS

Water provided for construction shall be obtained from a source approved by the Engineer and sufficient to provide for the anticipated needs of the contract. The City can provide water to the project through its distribution system. Use of City water will require the Contractor rent and use a City provided hydrant meter.

Water hauling equipment shall have watertight tanks of known capacity and shall be equipped with a pressure pump and spray system with the capability of applying the whole load uniformly. The spray system shall have a positive shut-off control. The water tank shall have a minimum capacity of 1,000 U.S. Gallons, and the capacity shall be clearly marked on the tank. The Contractor may be required to verify the tank capacity.

A water meter may be used for water dispensing, providing its measurement can be verified.

02204.4 METHOD OF MEASUREMENT

No separate measurement will be made for water used for pre-wetting, mixing, or compaction of earth materials or for dust control.

02204.5 BASIS OF PAYMENT

No separate payment will be made for water for construction.

02206.1 DESCRIPTION

This section covers activities associated with two types of temporary road use. These are construction and use of access roads and use of existing roads which are part of the construction zone.

02206.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 01300 - Submittals
Section 02005 – Traffic Control
Section 02015 - Clearing and Grubbing
Section 02105 - Earthwork Materials
Section 02202 – Roadway Excavation and Embankment

02206.1.2 SUBMITTALS

When gravel surfacing is required, the Contractor shall submit samples and/or test data for those materials in accordance with Sections 02105 and 01300.

02206.1.3 DEFINITIONS

Access Roads – A project site access road built specifically for temporary use by project related vehicles during the construction phase of the Work. The road may be on or partially on the construction zone or only end at it.

Temporary Use of Roads – Use of an existing paved or unpaved roadway during the construction phase of a project involving degradation of the surface and/or the use of the road by the public. Temporary road use may constitute use of the roadway as all or part of the construction zone or as an immediate approach to the construction zone.

02206.2 MATERIALS

02206.2.1 ACCESS ROADS

When shown on the Drawings, surfacing material for access roads shall be Untreated Base Course (UBC) gravel which meets the requirements of Section 02105.

02206.2.2 TEMPORARY USE OF ROADS

Materials requirements for restoring and resurfacing existing roads that have been damaged or disturbed during construction will be as shown on the Plans and described elsewhere within these Specifications.

02206.3 CONSTRUCTION REQUIREMENTS

02206.3.1 ACCESS ROADS

Consists of excavating, filling, installing gravel surfacing, and other work necessary to construct minor access roads for which cut and fill quantities will not be determined.

02206.3.1.1 CLEARING - The area to be disturbed by the road construction operation shall be cleared of all trees, brush, rubbish and other objectionable matter in accordance with Section 02015 prior to beginning the trenching operation. Trees, brush, rubbish and other materials resulting from the clearing operation shall be removed and disposed of at a land fill approved by the local public

authority or designated by the Engineer. Removal of these materials shall be considered as part of the Work for access road construction and no separate measurement and payment will be made for their removal.

02206.3.1.2 UNSUITABLE MATERIAL - Material shall be considered unsuitable for fill, sub-grade, shoulders and other uses if it contains organic matter, soft spongy earth or other matter of such nature that compaction to the specified density is unobtainable.

Material that is unsuitable for the intended use shall be excavated and removed from the site to an approved disposal site or otherwise disposed of as directed by the Engineer.

02206.3.1.3 SLOPES – Slopes shall be as follows:

- Excavation slopes shall be finished in conformance with the lines and grades shown on the Drawings. Debris and loose material shall be removed.

- Tops of slopes shall be rounded as shown on the Drawings. Excavation and embankment lines shall conform to those shown on the Drawings. When completed, the road grade shall be uniform and shall provide a smooth driving surface for vehicles.

02206.3.1.4 MATERIAL AVAILABILITY - The Contractor shall utilize all suitable excavated material within the roadway. When it is determined that sufficient excavated material is not available to construct required embankment, the Engineer may designate borrow sites and, if deemed to be changed conditions, appropriate changes will be negotiated in accordance with the General Conditions.

02206.3.1.5 COMPACTION - Materials in embankments shall be placed in layers not more than 12-inches in thickness and then wheel rolled with the equipment used for placement.

Placement of surfacing shall be made in accordance with the details shown on the Drawings and then compacted by wheel rolling with equipment used for placement.

02206.3.1.6 TRAFFIC CONTROL - At all points where access roads come into contact with public thoroughfares, the Contractor shall establish and maintain adequate traffic control as described in Section 02005 and as required by the specifications of the state or local highway or road department having authority at the site.

02206.3.1.7 ENVIRONMENTAL CONTROL – During construction and use of access roads, the Contractor shall observe the requirements of Section 01520 with particular regard to dust abatement.

02206.3.2 TEMPORARY USE OF ROADS

02206.3.2.1 TRAFFIC CONTROL - At all times when the Contractor is making temporary use of public thoroughfares, the Contractor shall establish and maintain adequate traffic control as described in Section 02005 and as required by the specifications of the state or local highway or road department having authority at the site.

02206.3.2.2 PASSIBILITY – When a portion of a public thoroughfare is being utilized for construction purposes, the Contractor shall maintain as many open lanes as possible for the passage of traffic consistent with safety and good construction practice. Lanes open to traffic shall be managed and maintained free of any debris or material that might affect passibility and public safety.

When traffic must be limited to the use of only one lane, traffic flow shall be managed so that no undue or unreasonable delays occur. If travel on all lanes of the roadway must be interrupted for

an extended period of time, the Contractor shall first prepare an adequate detour plan and have it approved by the local road or highway department.

02206.3.2.3 ENVIRONMENTAL CONTROL – While using existing roads for construction purposes, the Contractor shall observe and be responsible for the requirements of Section 01520 with particular regard to dust abatement. When sprinkling with water is being used to control dust, the Contractor shall make as many passes as are necessary, and as may be directed by the engineer, to keep the creation of dust at a minimum. While sprinkling, the Contractor shall take particular care to avoid creating slippery or otherwise hazardous conditions on any part of the roadway being used for vehicular traffic.

02206.4 METHOD OF MEASUREMENT

02206.4.1 CONSTRUCTION OF ROADS

Measurement for construction of access roads shall be made by the number of lineal feet of road excavated, compacted and graded to provide either a driveable surface or a base ready for installing gravel surfacing.

02206.4.2 GRAVEL SURFACING

Separate measurement for gravel surfacing shall be made in accordance with Section 02105 for Untreated Base Course.

02206.4.3 TEMPORARY USE OF ROADS

Restoration and resurfacing of roads disturbed or damaged during temporary use for construction shall be included with other items on the Bid Schedule and no measurement or payment for this work shall be made under this specification.

02206.5 BASIS OF PAYMENT

The accepted quantity will be paid for at the contract unit price for:

PAY ITEM	UNIT
Access Road	Lineal Foot

02208.1 DESCRIPTION

Furnish and place flowable fill for backfill in roadway trenches.

02208.1.1 MATERIALS

Cement – Use Portland Cement, Type I or II

Fly Ash – Loss on ignition must be 3% or less.

Fine Aggregate

Natural Sand
Meet the following gradation when test is specified.

Table 02208.1.1

Sieve Size	Percent Passing
No. 3/4	100
No. 100	0-10

02208.1.2 MIX DESIGN

Meet the following requirements.

Mix design compressive strength (28-day) – between 50 to 150 psi.

Portland Cement – at least 50 pounds/cubic yard

Fly Ash – at least 300 pounds/cubic yard

Slump – 6-10 inches maximum

02208.1.3 FINISH

Finish to a flat surface.

02208.2 METHOD OF MEASUREMENT

02208.2.1 The amount of flowable backfill shall be determined by measuring the lineal feet of trench requiring flowable backfill and accepted as called out in the Contract Documents. No measurement will be given to flowable backfill used in locations not required in the Drawings. Unless called out elsewhere, the measurement will begin and end two feet each side of the existing asphalt surface.

02208.3 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
Flowable Backfill	Lineal Foot

SPECIAL PROVISION

WATERLINE PIPE INSTALLATION — SECTION SP02222

02222.1 DESCRIPTION

This section covers furnishing and installation of pipe and fittings of the type, class and size designated for the water system defined on the Drawings, in these Specifications, and elsewhere in the Contract Documents.

Work under this specification will require the contractor secure a Wyoming DEQ WQD-WYPDES General Permit for Temporary Discharge Involving Construction Activities (Permit Number WYG740000).

Upon completion of construction activities, the contractor shall also file with WDEQ the Notice of Termination for Temporary Discharges available on the WDEQ website.

02222.1.1 RELATED WORK

Section 02105 - Earthwork Materials
Section 02200 - Trench Excavation and Backfill
Section 15110 - Pipe and Piping Systems
Section 15230 - Waterline Valves and Hydrants
Section 15232 - Water System Control Valves
Section 15234 - Water Service Connections
Section 15236 - Water Main Flow Meters

02222.1.2 SUBMITTALS

02222.1.2.1 MATERIALS AND EQUIPMENT - The Contractor shall submit for review complete information, showing all pipe, materials, fittings, gaskets, couplings, coatings, linings, supports, mechanical restraints, thrust blocks and configuration prior to the delivery of any components to the project. All information shall be provided in accordance with Section 01300 and written evidence of compliance from the manufacturer shall be provided with each delivery of material.

02222.1.2.2 TESTING - As construction proceeds, the Contractor shall submit test documentation in accordance with this section of these Specifications.

02222.1.3 DEFINITIONS

Fitting - Any component of a pipeline, excluding the pipe itself and valves and meters, which is used for connecting pipe sections; changing line direction or size; connecting meters, valves, tanks, etc.; or starting or terminating pipelines.

Mains - Water distribution pipes, located in streets or rights-of-ways, to which water service connections are made for users of the system.

Run - Any identified section of a pipeline.

Saddle - A fitting placed on a pipe to reinforce the pipe wall, through which a tapping hole is drilled.

Service Lateral – The line which connects to the water meter or to the service stub at the property line extending from there, on private property, to the plumbing at the foundation of a house or business.

Service Stub – The line running from the tap on a main to the meter or to the property line as appropriate.

Tap - The actual connection made to water mains which includes drilling an opening into the main, threading, installing a tapping saddle when appropriate, and installing a valve into the opening.

02222.2 MATERIALS

02222.2.1 PIPE AND FITTINGS

Shall include all pipe fittings and materials necessary to complete the connection, blowoff, manway, isolation valve and/or appurtenance detailed on the plans and shown on the bid schedule.

See Section SP15110 for additional detail.

02222.2.2 PIPELINE LOCATION IDENTIFIERS

Pipeline location identifiers generally take the form of fiberglass marker posts, steel sign posts, warning tape, and tracer wire.

02222.2.2.1 TRACER WIRE - Unless otherwise described on the plans or herein, the tracer wire shall be an insulated, #12, direct bury copper wire designed and manufactured for this purpose.

02222.2.2.2 WARNING TAPE - The warning tape shall be an inert, plastic, direct bury type with a 2-inch minimum width, of the appropriate safety color, and specifically manufactured for underground utility identification. The tape shall have wording imprinted on it identifying the type of utility it is protecting.

02222.2.2.3 FIBERGLASS MARKING POSTS - Shall be fiberglass compound of 5-foot length and 4 inches wide, or otherwise as shown on the Drawings. They shall be fitted with a deterioration resistant warning notice or label appropriate to the application.

02222.2.2.5 STEEL SIGN POSTS – Shall be 4-inch diameter schedule 80 steel pipe of 5-foot length with beveled top and affixed sign. Sign warning, label information and installation shall be as detailed on plans.

02222.2.3 MISCELLANEOUS FITTINGS AND MATERIALS

02222.2.3.1 POLYETHYLENE ENCASEMENT - Where soil conditions are determined to be severely corrosive and when shown on the Drawings or required in the Contract Documents, tubular polyethylene encasement shall be installed around buried ductile iron piping and fittings in accordance with ANSI/AWWA C-105.

02222.2.3.2 CASING PIPE - Where casing pipe is called for on the Drawings or is required by the Engineer, the Contractor shall furnish and install the casing in accordance with Sections 02315 and 02320 of these specifications.

02222.2.3.3 PIPE PENETRATION OR CASING SEALS - Where required on the Drawings or in these Specifications, the Contractor shall furnish and install pipe-to-wall linked rubber seals in core drilled structures, walls, pipe sleeves, or casings in accordance with the manufacturer's instructions. Seals shall be link seals by Thunderline Corporation, or an approved equal.

02222.2.3.4 PIPE RESTRAINTS – Pipe restraints shall be as follows:

- Concrete thrust blocking shall be formed, sized, and placed as described herein and shown on the Drawings. Reinforcing bars used in thrust block construction shall be preformed and fusion bonded epoxy coated.

- Mechanical restraint of piping shall be accomplished with one of the following restraining systems or an approved equal:

  ⇒ Grooved Ductile Iron AWWA Couplings by Victaulic Company of America (use only with exposed piping systems).

  ⇒ MEGALUG thrust restraints by EBAA Iron Sales, Inc.

  ⇒ FIELDLOK restraint gaskets by U.S. Pipe Company. Without the written approval of the Engineer, use of this restraint device is limited to joints in carrier pipe installed in a casing pipe.

All joints of pipe installed under streambeds or canal crossings, or installed in casing pipes, shall be protected with mechanical restraint. Pipe joints leading into and out of bends or fittings shall be restrained as detailed on the plans.

Restraint protection of above ground or exposed piping in buildings or enclosures shall be accomplished only with mechanical restraints.

02222.3 CONSTRUCTION REQUIREMENTS

02222.3.1 HANDLING AND APPROVAL OR REJECTION OF MATERIALS

All materials delivered to and used at the job site are subject to approval of the Engineer or the Owner. Care shall be taken during handling of pipe, to avoid any impact which might cause damage. Dropping pipe during unloading will not be permitted. Pipe will be carefully inspected in the field before and after laying. If any cause for rejection is discovered in a pipe before or after laying, it shall be removed and replaced by the Contractor, at no additional cost to the Owner. Any pipe found to be unfit or rejected due to cracks, broken bells or spigots, irreparable chipped lining, etc., shall be removed from the job site.

02222.3.2 DIAGRAMMATIC LAYOUT

Piping layout on the Drawings shall be considered diagrammatic for all piping not shown with detailed dimensions. When this is the case, pipe size and location are provided, but the Drawings are not intended to show every offset, fitting, or structural difficulty that will be encountered during project construction.

02222.3.3 ALTERATION OF ALIGNMENT

At no additional cost to the Owner, and with written permission from the Engineer and Owner, piping alignment may be varied from that shown on the Drawings, to avoid structural or mechanical difficulties, or to avoid the work of other trades. The Contractor still will be liable to provide all materials and labor required to complete all work in accordance with the best practice of the trade, and to the satisfaction of the Engineer.

Deflection of PVC pipe joints is not an acceptable method to achieve alignment changes.

02222.3.4 INSTALLATION

02222.3.4.1 DEWATERING - Prior to pipe laying and jointing, sufficient dewatering effort shall be provided to maintain the ground water level at or below the surface of the trench bottom or base of the bedding course. The dewatering operation, however accomplished, shall be carried out in such a manner as to not permanently disturb natural underground water conditions.

In cases where the trench soils are weak geosynthetic wrap of the bedding and shading is required to achieve a suitable foundation. The plan trench detail for weak soils contains locations where this requirement is anticipated.

02222.3.4.2 CONNECTION TO EXISTING FACILITIES - When connections are to be made to any existing pipe or appurtenances, for which the actual elevation or position cannot be determined without excavation, the Contractor shall excavate or hydrovac for, and expose the existing pipe or appurtenances before laying any new pipe. The Engineer shall be allowed to inspect the existing pipe or appurtenances before any connection is made. The Contractor shall make any adjustments in line or grade which may be necessary to accomplish the intent shown on the Drawings.

Where new fittings, valves, meters, restraints etc., are required to be installed in, or attached to, existing piping, or where connections are to be made to existing piping, the Contractor shall furnish and install the necessary components needed to accomplish the work, whether or not specifically indicated on the Drawings.

02222.3.4.3 CAPPING PIPE END - At the close of each workday, or whenever the work ceases for any reason, the end of the pipe shall be securely closed in accordance with AWWA C651 Section 5.2 to prevent infiltration of soil, rodents and water. Prior to resumption of joining operations or closure of openings the interior of the bedded pipe shall be inspected for foreign material and such material shall be swept and/or wiped from the pipe. When the plug is removed the previously bedded joint shall be inspected for debris and any found shall be removed.

02222.3.4.4 JOINING – Joining of pipe shall be as follows:

- When making connections, pipe shall be cut and beveled in a neat and workmanlike manner, so as to provide a smooth, beveled end at right angles to the axis of the pipe. Pipe and fittings shall be assembled so there will be no distortion or springing of the pipelines. Flanges, unions, flexible couplings and other connections shall come together at the proper orientation. The fit shall not be made by springing any piping, nor shall orientation or alignment be corrected by taking up on any flange bolts. Flange bolts, union halves, flexible connectors, etc., shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to fit.

- PVC pipe, 2 inches and smaller in diameter, shall be joined by solvent welding. No disturbance of joints, including from trench backfill operations, will be allowed until solvent welded joints are cured.

- PVC pipe, larger than 2 inches in diameter, shall be joined by means of gasketed joints. When field cuts are made, the spigot end shall be beveled to match the factory bevel and marked with the minimum and maximum insertion marks matching the factory distances.

- With bell and spigot joints, care should be taken to properly align the pipe before joints are forced home. Gaskets shall be lubricated in accordance with manufacturer's instructions. During insertion of the spigot end, the pipe shall be partially supported by hand, sling, or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since the most flexible gasketed joints tend to creep apart

when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home. Care shall be taken to stop insertion at the factory insertion mark leaving the second mark visible. Previous joints shall be watched for insertion creep as subsequent joints are assembled.

- Where fusion of polyethylene pipe joints is required, sections of pipe shall be joined in a continuous length on the job site. Joining shall be by the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. Equipment used for butt fusion joining shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and fusion pressures.

02222.3.4.5 LAYING - All pipe laid shall be retained in position, using mechanical means if necessary, so as to maintain alignment and joint closure until sufficient pipe bedding and backfill have been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the plans, within specified limits. No blocking of any kind shall be used to adjust the pipe to grade, except when used with concrete embedment. Bedding materials shall be placed so the bottom surface of the pipe will have full bearing for the entire barrel length. The pipe shall rest on not less than 1/4 of its outside perimeter. Bell holes shall be dug as required to assure uniform support along the barrel but shall be no larger than necessary.

Unless otherwise approved by the Engineer, pipe shall be laid upgrade from the point of connection on the existing pipeline or from a designated starting point. Pipe shall be installed with the bell end forward or upgrade, unless approved otherwise. When pipe laying is not in progress, the forward end of the pipe shall be kept closed with an approved temporary plug.

02222.3.4.6 PIPE RESTRAINT – Pipe restraint work shall be as follows:

- The Contractor shall provide and install either concrete thrust blocks or mechanical pipe restraints on all pressure piping not connected with bolted flanges or welded joints.

- For projects involving pipeline construction covered under this section of the Specifications, a pipe restraint schedule is included in the Drawings. Pipe restraints (thrust blocks and/or mechanical restraints) shall be furnished and/or constructed and installed as shown on the Drawings and described in the schedule including restraint of gasketed pipe joints leading into and out of fittings.

- Pressure pipe shall be properly blocked or restrained at all fittings, wherever the pipeline makes a change in direction of 5 degrees or more, wherever it changes sizes, or wherever it ends.

- Placement of concrete thrust blocking shall provide bearing against undisturbed vertical earth banks or approved compacted backfill, sufficient to absorb thrust from line pressure, and in a configuration so that pipe joints and fittings will be accessible. Sides of thrust blocks shall be formed to contain the block and provide a reasonably vertical side surface.

- All restraints shall be in place before any hydrostatic testing and flushing are performed on the system.

- The Contractor shall allow visual inspection of every thrust block or mechanical restraint before it is buried.

02222.3.4.7 FINISH BEDDING - After the pipe is laid, additional bedding material shall be placed in 6-inch lifts to a level even with the spring line of the pipe and compacted. The portion of the trench from the spring line to 12 inches above the top of the pipe shall then be filled and compacted in the same way.

02222.3.4.8 REQUIREMENTS FOR INSTALLATION NEAR SEWER LINES - Locate potable water piping at least 10 feet horizontally (measured edge to edge) from any existing or proposed parallel sewer or wastewater leach line. Should conditions prevent the 10-foot separation, upon the Engineers approval the water line may be laid closer than 10 feet to sewer lines (but not leach lines) provided:

- The water line is laid 18 inches above the top of the sewer line, but deep enough to prevent freezing, and
- There is no groundwater impacting the trench, and
- No sewer force main exists, and
- The water line is laid in a separate trench, or
- The water line is laid on an undisturbed earth shelf on one side of the sewer line trench, or

Where potable water lines cross sewer lines, the bottom of the water line shall be at least 18 inches above the top of the sewer line for ten feet on each side of the sewer line, measuring perpendicularly from the water line to the sewer line. When such vertical separation is impossible to achieve, a vertical separation of less than 18 inches may be allowed provided:

- In new construction for both water line and sewer line they shall be constructed of ductile iron pipe or thermoplastic pipe joined by either mechanical or bolted flange joints.
- In situations with an existing sewer line, the new water line shall be constructed as previously described.
- And, when making such crossing, install the water line in such manner that the center of a full length of pipe is on the centerline of the sewer line to isolate the water line joints as far as possible from the sewer line.

02222.3.4.9 EXPOSED PIPING - No exposed piping shall be installed until all equipment to which the pipe is to be attached has been installed and it can be determined where piping and fittings shall be located to make a neat, efficient arrangement. Piping shall be aligned with equipment connections such that no external load or stress will be transferred to any equipment from the piping. Piping shall be installed with a sufficient number of unions, flexible couplings, or flanged joints, in addition to those shown on the Drawings, to allow for convenient inspection and maintenance.

Exposed pipe work shall be suspended or supported, to prevent sagging or over-stressing of the pipe and connections. Assembly of pipe and fittings shall be accomplished so there will be no distortion or springing of the pipe. The fit shall not be made nor the alignment corrected by taking up on any flange bolts. Joints shall come together in proper orientation, and Flange bolts, union halves, flexible couplings, and etc. shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to make the fit meeting the above requirements.

Exposed pipe shall be installed in straight runs parallel to the axis of the structures. Pipe runs shall be horizontal and vertical; except that gravity drain lines shall be pitched down in the direction of flow at a slope not less than 1/8 inch per foot.

All exposed pipe shall be painted in accordance with Section 09910 of these Specifications. Factory finished items are not required to be field painted except touch-up. The color and type of paint used shall be submitted to the Engineer for his approval.

02222.3.4.10 PIPELINE APPURTENANCES – The work shall include number pipeline appurtenances such as isolation valves, manways, blowoffs, valves, air vacs, markers and etc. These features are detailed in the drawings and include ancillary thrust blocks, vaults, bollards, pipeline markers cathodic protection and etc. The ancillary items associated with the features shall be installed as part of the appurtenance installation and are considered part of the appurtenance.

02222.3.4.11 VIDEO INSPECTION – The Contractor shall provide video inspection of the cleaned pipeline prior to flushing of the line. On the Steel pipeline, the video inspection can occur after full installation using the manway accesses. On the PVC pipe, video inspection records shall be taken at intervals determined by the reach of the camera equipment used by the Contractor. The beginning and end of the video records shall reference the pipeline station number.

02222.3.5 DRAINS AND OTHER SYSTEMS

DRAINS AND OTHER SYSTEMS - In addition to other requirements in this Section, all valve vent and other lines fitted with drains shall be installed such that continuous slope is maintained to designated drain locations. In areas where there are both drinking water pipelines and irrigation pipelines, exposed portions of irrigation water piping shall be identified by distinctive coloring or other marking. Drinking and irrigation lines and extensions shall be completely separated, installed in separate trenches, and there shall be no cross-connection between the systems under any circumstances.

02222.3.6 FLUSHING AND CLEANING

Due to the diameter and length of the pipeline, flushing the pipeline will produce a considerable volume of water. To minimize that volume the installation measures outlined in Section 02223.3.4.3 shall be followed. The Contractor may propose alternate method for flushing and cleaning for review by the Engineer. Such methods shall conform to AWWA C-651 Disinfecting Water Mains and C-655 Field De-chlorination. The following pipeline cleaning approach is required in absence of an alternate proposal. The Contractor shall submit a written narrative of specific equipment, material, and supplies to be supplied for cleaning flushing, pressure testing, and chlorination/de-chlorination activities as well as a field- specific procedure for each activity. The JPWB and the City of Rock Springs shall supervise disinfection techniques by the Contractor when cutting into existing mains for connection.

a) In addition to the measures outlined in 02222.3.4.3, the steel pipe section shall require sweeping and removal of loose grout remains or grout nibs and the brooming of the full circumference at the grouted joints. Sand, soil and dust shall be collected and removed from the pipeline.

b) Manways and Blowoffs shall be used to flush the remaining dust size particles from the pipeline beginning at the upper end of the pipeline and moving southward. Water can be supplied from the Wind River Tank. This will require connection to the existing 18-inch pipeline and substitution of an 18-inch spool piece in place of the Check valve at Sta. 145+40. This connection to the 18-inch will require cleaning and swabbing of all fittings and pipe between the exiting line and the check valve vault.

c) During flushing operations, the suction and discharge valves within the pump station shall remain closed. The blind flange to blind flange within the suction pit (Detail C,

Sheet D1) may be replaced temporarily to allow passage of flushing flows and disinfection slugs through the pump station.

d) Blowoffs discharge to existing drainages and must be monitored by the contractor during flushing operations to insure water does not create downstream property damage.

02222.3.6.1 FLUSHING WITH WATER - Prior to proceeding with pressure testing and/or disinfection of completed lines, the Contractor shall fill the test section with clean, potable water and flush the lines. The Contractor shall furnish all equipment and labor to complete the flushing as required by this section. Water for flushing shall be provided by the Owner.

02222.3.6.2 DIFFICULT CONTAMINANTS - Certain contaminants, especially in caked deposits, resist flushing at any velocity. If, in the opinion of the Engineer, such contaminants have entered the line during construction and were not cleared as required, the interior of the pipe shall be swabbed, as necessary, to remove the debris prior to proceeding with flushing.

02222.3.6.3 MINIMUM FLUSHING FLOW AND VELOCITY - The Contractor shall flush each blowoff using the available head at the location of the blowoff and maintain such flow until the water clears. Flushing shall proceed until the installed pipe is free of remaining dust and particulates. The flow needed to produce a 2.5 fps flushing velocity are provided in the table below however downstream drainage channel observations will determine if these flow rates are possible.

FLUSHING FLOW AND VELOCITY

Pipe Diameter (inches)	Flow (gpm) to Produce 2.5 fps
4	100
6	200
8	400
10	600
12	900
16	1600
18	2000
24	3500
30	5500
36	7900

NOTE: With 40 psi residual pressure, 2 1/2 inch and 4-1/2 inch hydrant outlet nozzles will have the ability to discharge approximately 1,000 GPM and 2,500 GPM respectively.

02222.3.7 TESTING

The Contractor shall perform all testing, and shall furnish all materials, equipment, and labor necessary to complete this work as required. Any work that fails to meet the acceptance criteria of prescribed testing shall be repaired and/or replaced at no additional cost to the owner. All repaired work shall be re-tested. This sequence shall be repeated until the work meets the acceptance criteria.

02222.3.7.1 PRESSURE TESTING - All pipelines constructed for carrying potable, non-potable, and water-borne products shall be pressure tested for leakage when they are completely assembled, unless directed otherwise in these Specifications or in writing by the Engineer.

WARNING - The hydrostatic test procedures described herein are not applicable to air pressure testing.

Prior to pressurization all required flushing shall have been completed. Pipeline sections to be tested shall be isolated from any connecting lines. Air release taps shall be provided at points of highest elevation, the test section shall be filled with clean potable water, and all air shall be removed from the line. Pressure on the test section shall then be brought to full test pressure and maintained at that level for a period of not less than 4 hours. Pipelines shall be tested at 50 psi over normal static pressures shown on the Drawings or to the manufacturer's class rating, whichever is lower. Permanent plugs shall be inserted into the air release tap holes after the test has been completed.

For estimates of testing water volumes, the pipeline is divided into the following sections by valves. Additional valves, blind flanges, bracing, and piping required for testing shall be provided by the Contractor at no additional Cost.

Design Valve Locations:
Station 0+00 (Tie-in to AC)
Station 18+38
Station 31+95
Station 37+00 (Inside Pump Station)
Station 37+80
Station 78+45
Station 78+50
Station 107+00
Station 144+30
Station 146+20 (Tie-in near Wind River Tank)

Note: The above list of valves does not include additional valves at lateral tie-in locations shown on the plans.

Pressure testing shall be carried out on a segment by segment basis. Shorter segments may be combined into a single longer test segment. Any weld-o-lets or tapping saddles required for pressurization shall be included in the testing cost at no additional cost to the owner. Permanent plugs shall be inserted into any test tap holes after the test has been completed and permanently treated with pipe coating material. The location of any temporary tap shall be noted on the drawings.

02222.3.7.2 LEAKAGE TESTING - The leakage test shall be conducted concurrent with the pressure test. Testing allowance shall be defined as the maximum quantity of makeup water that is added into a pipeline undergoing hydrostatic pressure testing, or any valved section thereof, in order to maintain pressure within ±5 psi (34.5 kPa) of the specified test pressure (after the pipeline has been filled with water and the air has been expelled*) No pipe installation will be accepted if the quantity of makeup water is greater than that determined by the following formula:

In inch-pound units, $L = SD(P^{0.5})/148{,}000$

where:
L = Testing allowance (makeup water), in gallons per hour
S = Length of pipe tested, in feet
D = Nominal diameter of the pipe, in inches
P = Average test pressure during the hydrostatic test, in pounds per square inch (gauge)

To accommodate valve seat leakage, when testing against new closed valves, makeup water per closed valve of 0.0078 gal/hr/in of nominal valve size shall be allowed. This is in addition to the allowable leakage defined above.

When the allowed amount of leakage is exceeded, leaks shall be located and repaired and the system shall then be re-tested by the Contractor until compliance is achieved.

All visible leaks in exposed pipe shall be repaired.

02222.3.7. 3 NON-RIGID PIPE DEFLECTION TESTING - At the Engineer's request, the Contractor shall test requested portions of all non-rigid pipe after being installed and backfilled to ensure that circumferential deflection does not exceed 5% of the diameter. Such test will consist of passing a mandrel through an open section of pipe, sized appropriately to detect non-compliance. The mandrel shall be sized in accordance with the requirements provided in Section 02224 for checking sewer pipe. In the event deflection non-compliance is found, the Contractor shall make repairs as outlined in Section 02224 and additional testing of other sections of pipe will be requested.

02222.3.7.4 TESTING DOCUMENTATION - The Contractor shall maintain a record of all testing performed, together with the test results obtained, for each line installed under this Contract. Minimum information to be included in these records shall be as follows:

- All Documents:
  - Date of issuance of the record
  - Name of Contract
  - Contractor's name and address

- Disinfection Report:
  - Name and address of treatment supervisor
  - Disinfection method used
  - Location and boundary description of section to be disinfected
  - Time and date of disinfectant introduction
  - Time and date of disinfectant release
  - Initial disinfectant residual (PPM) for each outlet tested
  - Time and date of flushing after disinfection
  - Signature of treatment supervisor (signifies completion of disinfection activities)

- Bacteriological Report:
  - Date issued
  - Project name and location
  - Laboratory's name, certification number, address and phone number
  - Test location
  - Time and date of sample collection
  - Name of person collecting sample
  - Time and date of laboratory test start
  - Test Procedure (AWWA C655)
  - Coliform bacteria test results for each sample
  - Certification that water conforms (or fails to conform) to bacterial standards of the appropriate state public drinking water regulations
  - Bacteriologist's signature

- Test Report:
  - Type of test
  - Location of test
  - Sizes, types, and lengths of pipe in test section, and test boundary description

- Date and Time test started
- Date and Time test completed
- Test pressure (*Pressure Test only*)
- Amount of leakage/allowable leakage (*Pressure Test only*)
- Mandrel dimensions(*Obstruction and Non-Rigid Pipe Deflection Tests only*)
- Test result (*pass/fail*) (*All Tests*)
- Printed Name/Signature and Date of Test Supervisor (Contractor's representative) (*All Tests*)
- Printed Name/Signature of Inspector (Engineer's representative) witnessing and approving the test (*All Tests*)

02222.3.8 DISINFECTION

02222.3.8.1 REGULATORY COMPLIANCE - All pipelines to be used for drinking water service shall be disinfected in accordance with the requirements of state and local public drinking water regulations. The JPWB and the City of Rock Springs shall supervise disinfection techniques by the Contractor when cutting into existing mains for connection.

02222.3.8.2 METHODS - The Contractor may use any method which complies with the above referenced standards; however, the "slug method", prescribed in ANSI/AWWA C-651, is preferred due to the reduction in required water volume. This method consists of filling a segment of line line with potable water and then injecting a "slug" of concentrated chlorine solution (100 mg/L) at the upstream end of the line . (The slug of water shall be batched outside the pipeline in a water truck or other tankage.) This slug of water is then allowed to sit in the line for a period of 3 hours and moved down the line using the downsteam valves to control the velocity to achieve a 3 hour contact time. A 40,000 gallon slug will fill about 1,000 feet of pipe. To achieve a contact time of 3 hours the slug will move at about 5 feet per minute. The downstream segment shall be filled to maintain the integrity of the slug in steep areas. If the measured residual is less than 50 mg/l the slug will be re-chlorinated before proceeding with further line segments.. Once passed, the slug water is then moved through the line to the next segment by opening the valve on the lower end. A target flow of 180 to 190 gpm will achieve the desired 3-hour contact time. When properly conducted, this procedure provides contact to the interior pipe surfaces with a concentrated dose of chlorine to achieve disinfection. Care must be taken to insure highly concentrated chlorine does not come into contact with the mortar lining of the steel pipe. South of I-80 the water and chlorine slug will be pushed from near Station 0+00 toward Station 21+60.

Spool pieces, valves, or other fittings temporarily removed from service to accommodate flushing and chlorination shall be swabbed or sprayed with a 1,000 mg/l concentrated chlorine as they are reinstalled.

02222.3.8.3 DECHLORINATION - After disinfection, the lines shall be flushed toward a collection point anticipated to be near Station 21+60 where it shall be collected and chemically dechlorinated in tankage provided by the Contractor. All operations shall conform to the Contractor obtained General Permit for Temporary Discharge Involving Construction Activities (Permit Number WYG740000).

02222.3.8.4 FLUSHING - After disinfection, the lines shall be flushed until residual chlorine is reduced to the levels equal to the prevailing levels in the supply. Samples for bacteriological testing can then be taken. The Contractor shall safely and legally dispose of contaminated water used for disinfection after consultation with the local authorities. Under no circumstances shall heavily chlorinated water be allowed to mix with "live" waters, meaning waters in lakes, rivers, streams or wetlands. The Contractor shall be responsible for obtaining a Wyoming Pollutant Discharge Elimination System (WYPDES) permit prior to flushing the line.

02222.3.9 PIPELINE LOCATION IDENTIFIERS

The Contractor shall furnish and install such identifiers as shown on the Drawings and/or prescribed in these Specifications.

02222.3.9.1 TRACER WIRE – Tracer wire shall always be installed in the trench with non-metallic pipelines, during or immediately following their installation and may be required in the installation of metallic pipelines where electric conductance is necessary and is not provided through the pipeline because of its type of construction. Tracer wire placement shall be as shown on the Plans but shall generally be immediately above the pipeline centerline with approximately 4 to 12 inches of separation. Tracer wire shall be brought to the surface of the ground at all valves and risers and where otherwise shown on the plans.

Tracer wire shall be installed as shown in the Plan details. Where splices in the wire are required, the Contractor shall use the manufacturer recommended splice nut (cap) to provide a watertight joint. Extend electrical tape well over the wire insulation in all directions.

The Contractor shall provide all necessary labor, equipment, and materials to perform an electrical continuity test prior to acceptance on all installed tracer wire. The test shall be performed in the presence of the Engineer or an appointed representative. The continuity test shall be conducted using an ohmmeter. Continuity must be demonstrated to pass the test. In the event of a failed test, the Contractor shall make all necessary repairs required to provide a tracer wire system that complies with the testing requirements of this section.

Some soil conditions and/or installation circumstances may require the additional installation of cathodic protection for the tracer wire. When this is the case, cathodic protection will appear as a separate bid item and details for its installation will appear on the Plans and elsewhere in these Specifications.

02222.3.9.2 WARNING TAPE – A continuous ribbon of warning tape shall be installed during the backfill operation. Tape shall be placed a minimum of 12 to 24-inches above the top of the pipeline or at a depth approved by the Engineer, or otherwise as shown on the drawings. At roll ends and at places where the tape has been broken, the loose ends shall be tied together to prevent separation during the rest of backfill.

02222.3.9.3 MARKING POSTS – Marking posts shall be installed at the placement intervals shown on the Plans. Posts shall not be deformed or damaged during installation. The Contractor shall use a post hole digger to install markers when there is danger of damage to posts from pounding or hammering

02222.3.10 CLEANUP

Following acceptance of testing and completion of backfilling and surface restoration, the Contractor shall prepare the work for contract closeout in accordance with Section 01200 of these Specifications.

02222.3.11 VIDEO INSPECTION – The steel pipe shall be inspected by CCTV to inspect for debris and completed grouting of the welded joints. Digital recordings of the inspection shall be delivered to the Engineer.

02222.4 METHOD OF MEASUREMENT

02222.4.1 BURIED WATER LINES

The amount of buried water line pipe shall be determined by measuring the lineal feet of pipe in place and accepted, including the lengths of fittings, valves, couplings, and portions of pipe within casings, unless called out otherwise in the Contract Documents.

Measurement of lines passing through or connecting to control valves or other operating devices enclosed in vaults or manholes, shall be made only up to the pay limit of the enclosure or vault as shown on the Drawings. If no pay limit is shown, measurement will be made to a point five (5) feet outside of the enclosure.

Measurement of ductile iron pipe shall include polyethylene encasement where that material is required.

02222.4.2 PIPELINE LOCATION IDENTIFIERS

Measurement of tracer wire and location markers installed with non-metallic pipe shall be included in the measurement of the waterline pipe unless they are separate bid items in which case measurement for tracer wire shall be the same as the length of waterline installed and location markers shall be measured by counting the number of markers installed.

02222.4.3 EXPOSED PIPELINES

Exposed water pipe shall not be measured in connection with the installation of water lines but shall be included in the measurement of the structure or facility where the exposed pipe is located, and payment for such pipe shall be included in the payment for those bid items.

02222.4.4 FITTINGS

Unless specifically called out for separate payment on the Bid Schedule, fittings for pipelines and piping systems will be considered appurtenant to the line or system being installed, and measurement for such fittings will be included in the measurement for that pipeline or piping system.

02222.4.5 MISCELLANEOUS

Separate measurement for valves and vaults and enclosures and their contents will be as described in other sections of these Specifications.

02222.4.6 APPURTENANCES AND CONNECTIONS

Measurement for connections to existing pipelines will include the fittings, fabrication, special pipe, valves, cathodic protection, earthwork etc. associated with the line item. All labor, equipment and materials shall be included with the respective bid item.

Measurement for Manways, Manways with Air/Vac, Air/Vac shall include couplings, vaults, lids, bollards, valves, restraints and other materials needed to construct the installation as depicted on the plans. Measurement for pipeline markers shall be by the each for the respective type of marker. No separate payment will be made for fittings unless called for on the Bid Schedule.

02222.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
30" PVC DR 25 Class 165 AWWA C-900	L.F.
Blow Off Assembly(Detail C, D14)	Each
Connection to Existing Pipeline Sta. 0+00 and 146+26	L.S.
18-inch Check Valve Sta 145+40	Each
Connection to Existing Pipeline 30” x 12” (Detail C, D8)	L.S.
Manway with (1)Air/Vac (Detail A, D11)	Each
Manway with (2) Air/Vac(Detail A, D9)	Each
Manway(Detail A, D12)	Each
Air/Vac Assembly(Detail C, D12)	Each
Manway with Air Release (Detail A, D11)	Each
Fiberglass Marker Post(Detail A, D21)	Each
Waterline Sign Post(Detail E, D20)	Each

No separate payment will be made for fittings unless called for on the Bid Schedule.

02224.1 DESCRIPTION

Includes furnishing and installation of pipe, fittings and manholes and their appurtenances for sanitary and storm sewers and subsurface drainage systems.

02224.1.1 RELATED WORK

Section 02105 - Earthwork Materials
Section 02200 - Trench Excavation and Backfill
Section 03500 - Pre-Cast Concrete Components
Section 15110 - Pipe and Piping Systems

02224.1.2 DEFINITIONS

Culvert - A section of pipe installed transversely under a road, highway, railroad, or canal for the purpose of conveying water flow.

Fitting - Any component of a pipeline, excluding the pipe itself, which is used for connecting pipe sections or connecting to valves, tanks, structures, etc.

Flowline - A line formed by the inverts of a pipeline.

Infiltration - Any uncontrolled seepage of groundwater into a sewer line or system.

Inflow - Any water entering a sewer.

Invert - The bottom or lowest point of the internal surface of a cross-section of a pipeline.

Lateral - Any line which connects to, and extends from, a sewer main line. A Service Lateral is any line which connects to a sewer service stub at the property line and extends on private property to the sewer plumbing at the foundation of a house or business.

Permeability - The property of a material which describes the rate of movement of any fluid through the pores of the material.

Resilient Connector - A flexible (rubber, plastic, etc.) connection fitting manufactured specifically for joining one pipe to another or to a structure, and capable of being deflected or deformed without leakage.

Run - Any identified section of a pipeline.

Service Stub - The line which connects to a sewer main line at the service tap and extends from there to the property line.

Service Taps - Connections to sewer main collection lines from individual services.

Springline - The points of maximum horizontal distance on the inside surface of a circular pipe or in rectangular pipe; the mid height of the internal vertical walls.

02224.1.3 SUBMITTALS

The Contractor shall submit for review, complete information for pipe, fittings, gaskets, manholes, prefabricated boxes and entry covers which clearly describes those materials and their finishes and interior coatings. This information shall be furnished to the Engineer before delivery orders for materials are placed with the respective suppliers.

All information shall be provided in accordance with Section 01300 and written evidence of compliance shall be provided with each delivery of material.

02224.2 MATERIALS

02224.2.1 PIPE

See Section 15110 for pipe materials specifications.

02224.2.2 MANHOLES AND ENCLOSURES

02224.2.2.1 MANHOLES - Manholes consist of the base, riser, cone, grade rings, rings and covers. Manholes shall be constructed of pre-cast, reinforced concrete and shall conform to the Drawings, to Section 03500 of these Specifications, and to ASTM Standard C478. Unless shown otherwise on the Drawings, the wall thickness of 48-inch and 60 inch manholes shall be minimum 5-inches and 6-inches respectively. Cone sections shall be eccentric and be designed to meet AASHTO HS-20 loading requirements. Pipe connections and/or knockouts shall be sized and located according to the Drawings. Grade rings shall have 4-inches minimum vertical thickness. No more than two grade rings per manhole shall be used.

02224.2.2.2 JOINTS - All manhole components shall be joined with tongue and groove joints and joints shall be sealed so that they are watertight. Sealant materials shall be flexible butyl resin sealant which conforms to AASHTO M-198B, or a rubber gasket may be used if it is specifically designed for installation in concrete manholes and conforms to ASTM C-361.

02224.2.2.3 RINGS AND COVERS - Manhole rings and covers shall be cast iron, be H-20 loading rated, be manufactured to fit the concrete openings of the manhole and shall meet the requirements of ASTM A48, Class 30B. The clear opening of the ring shall be 24-inches minimum. Vented covers, without dustpans, shall be provided for all manholes located where drainage or flooding will not occur. Watertight covers shall be provided wherever the manhole may be flooded with street runoff or floodwater. Combined weight of the ring and cover shall be not less than 360-pounds. All covers shall have cast into the upper surface the word "SEWER" and other lettering and insignias as may be shown on the plans.

02224.2.2.4 STEPS - Plastic or fiberglass steps reinforced with steel, which conform to ASTM C487 or ASTM C478 standards, shall be installed in all sections of each manhole as shown on the Drawings.

02224.2.2.5 CONNECTIONS - All connections to the manhole with piping shall be made with flexible positive seal, watertight gaskets or boots manufactured by Forsheda NPC, Inc., or an approved equal which meets the requirements of ASTM C923.

02224.2.3 PIPELINE LOCATION IDENTIFIERS

Pipeline location identifiers generally take the form of warning tape, and tracer wire. The Contractor shall furnish and install such identifiers as shown on the Drawings and prescribed in these Specifications.

02224.2.4 TRACER WIRE – Tracer wire shall always be installed in the trench with non-metallic pipelines, during or immediately following their installation and may be required in the installation of metallic pipelines where electric conductance is necessary and is not provided through the pipeline because of its type of construction. Tracer wire placement shall be as shown on the Plans but shall generally be immediately beneath (preferred), to the side, or above the pipeline with approximately 4 inches of separation. Tracer wire shall be brought to the surface of the ground at all manholes and where otherwise shown on the plans.

Tracer wire shall be installed as shown in the Plan details. Where splices in the wire are required, the Contractor shall use the manufacturer recommended splice nut (cap) to provide a watertight joint. Extend electrical tape well over the wire insulation in all directions.

The Contractor shall provide all necessary labor, equipment, and materials to perform an electrical continuity test prior to acceptance on all installed tracer wire. The test shall be performed in the presence of the Engineer or an appointed representative. The continuity test shall be conducted using an ohmmeter. Continuity must be demonstrated to pass the test. In the event of a failed test, the Contractor shall make all necessary repairs required to provide a tracer wire system that complies with the testing requirements of this section.

Some soil conditions and/or installation circumstances may require the additional installation of cathodic protection for the tracer wire. When this is the case, cathodic protection will appear as a separate bid item and details for its installation will appear on the Plans and elsewhere in these Specifications.

02224.2.5 WARNING TAPE – A continuous ribbon of warning tape shall be installed during the backfill operation. Tape shall be placed a minimum of 12-inches above the top of the pipeline or at a depth approved by the Engineer, or otherwise as shown on the drawings. At roll ends and at places where the tape has been broken, the loose ends shall be tied together to prevent separation during the rest of backfill.

02224.3 CONSTRUCTION REQUIREMENTS

02224.3.1 HANDLING AND APPROVAL OR REJECTION OF MATERIALS

Care shall be taken during unloading and hauling to avoid impact which might damage the pipe. Pipe dropped during unloading shall not be installed unless approved by the Engineer and may be rejected by the Engineer. Pipe will be carefully inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be removed and replaced by the Contractor at no additional cost to the Owner. Any pipe which is found to be unfit or is rejected due to cracks, broken bells or spigots, chipped exterior or lining, etc., shall be removed from the job site.

02224.3.2 TRENCHING

Excavation and backfill of trenches for sewer piping and manholes shall be performed in accordance with Section 02200 – "Trench Excavation and Backfill" of these Specifications.

02224.3.3 PIPE INSTALLATION

02224.3.3.1 DEWATERING - Prior to pipe laying and jointing, when water is present in the trench, sufficient de-watering effort shall be made to maintain the water level at or below the surface of the trench bottom or the base of the bedding course. The de-watering operation; however accomplished, shall be carried out in such a manner as not to permanently disturb natural groundwater conditions.

02224.3.3.2 CONNECTION TO EXISTING WORK - When connections are to be made to any existing pipe, conduit, or other appurtenance for which the actual elevation or position cannot be determined without excavation, the Contractor shall excavate for, and expose the existing pipe conduit, etc., before laying any new pipe or conduit. The Contractor shall furnish and install the necessary couplings, fittings, etc., needed to accomplish the cutting in, or connections, whether or not specifically indicated on the Drawings.

The Engineer shall be allowed to inspect the existing pipe or conduit before any connection is made. The Engineer may then make adjustments as required in the line and grade to accomplish the intent shown on the Drawings.

02224.3.3.3 PIPE JOINING – Pipe joining shall be as follows:

- When making connections, pipe shall be cut in a neat and workmanlike manner and beveled so as to provide a smooth end at right angles to the axis of the pipe. Pipe and fittings shall be assembled so there will be no distortion or springing of the pipelines. Care must be taken to properly align the pipe before joints are forced home.

- Where fusion of polyethylene pipe joints is required, sections of pipe shall be joined in a continuous length on the job site above ground. Joining shall be by the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. Equipment used for butt fusion joining shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and fusion pressures.

- PVC pipe, 2 inches and smaller in diameter, shall be joined by solvent welding. No disturbance of joints, including from trench backfill operations, will be allowed until solvent welded joints are cured.

- PVC pipe, larger than 2 inches in diameter, shall be joined by means of gasketed joints.

- With bell and spigot joints, care should be taken to properly align the pipe before joints are forced home. Gaskets shall be lubricated in accordance with manufacturer's instructions. During insertion of the spigot end, the pipe shall be partially supported by hand, sling, or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since the most flexible gasketed joints tend to creep apart when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.

02224.3.3.4 PIPE LAYING - All pipe shall be laid to conform to the prescribed line and grade shown on the plans, within specified limits, if any. No blocking of any kind shall be used to adjust the pipe to grade, except when used with concrete embedment. Unless otherwise approved by the Engineer, pipe shall be laid upgrade from the point of connection on the existing pipeline or from a designated starting point. The pipe shall be installed with the bell end forward or upgrade, unless approved otherwise.

The Contractor shall install gravity sewer pipelines at the proper slope by the use of a laser targeting system. Lasers shall be set at the proper slope in manholes and targets shall be affixed at the end of pipe sections being installed. As an alternative to targets, the laser beam may be set at the sewer invert, slope, and elevation. The inside bottom surface of the pipeline will be set directly next to the laser beam. Gravity sewer pipeline alignment shall be a straight line, both vertically and horizontally, between manholes.

All pipe laid shall be retained in position, by mechanical means if necessary, so as to maintain alignment and joint closure until sufficient pipe bedding and backfill have been installed to adequately hold the pipe in place.

02224.3.3.5 PIPE BEDDING - Bedding materials shall be placed so the bottom surface of the pipe will have full bearing for the entire barrel length. The pipe shall rest on not less than 1/4 of its outside perimeter. Bell holes shall be dug as required to assure uniform support along the barrel, but shall be no larger than necessary. After the pipe is laid, additional bedding material shall be placed and compacted in 6-inch lifts to a level even with the spring line of the pipe. The portion of the trench from the spring line to 12 inches above the top of the pipe shall then be filled and compacted in the same way.

02224.3.3.6 COVERING PIPE END - At the close of each workday, or whenever the work ceases for any reason, the end of the pipe shall be securely covered or plugged, unless otherwise permitted by the Engineer.

02224.3.3.7 CONSTRUCTION NEAR CULINARY WATER LINES - Locate sewer lines at least 10 feet horizontally from any existing or proposed parallel culinary water line. When installation conditions prevent the 10-foot separation, the sewer and water lines may be laid closer, provided

- The elevation of the bottom of the water line is at least 18-inches above the top of the sewer pipe, and
- The water line is laid in a separate trench, or
- The waterline is laid on an undisturbed earth shelf on one side of the sewer line trench, or
- The waterline is laid in a sewer or drainline trench which has been backfilled and compacted to not less than 95% of maximum density determined by ASTM D-690.
- Where culinary water lines and sewer lines cross, either above or below the other, the lines shall be placed:
    - ♦ So as to provide a minimum separation of 18-inches between the top of one line and the bottom of the other;
    - ♦ So that the joints of each are equidistant on either side of the other line with as much separation as possible;
    - ♦ So that, where a sewer line crosses over a water line, the sewer line is adequately supported to prevent it sagging or falling onto the water line and causing damage to it
- In such crossings, where the foregoing vertical and horizontal requirements are impossible to achieve:
    - ♦ The sewer shall be designed and constructed of cast iron, ductile iron, galvanized steel, or other protected steel as approved;
    - ♦ Such construction shall extend for a minimum distance of ten feet on each side of the point of crossing;
    - ♦ Mechanical joints shall be used.
- As an alternative, the Engineer may approve installation of the sewer pipe so that it is fully encased in 12-inch thick concrete for a distance at least 10-feet each side of the crossing.

02224.3.4 PRESSURE PIPE RESTRAINT

02224.3.4.1 THRUST BLOCKS - Thrust blocks and/or mechanical restraints shall be installed on pressure pipelines in accordance with these Specifications and Drawings before any hydrostatic testing is performed on the system. Pressure pipe shall be properly blocked at all fittings whenever:

- The pipeline makes a change in direction of 11 degrees or more,
- It changes size, or
- It terminates (see restraining details in Drawings).

02224.3.4.2 CONCRETE THRUST BLOCKS - Concrete thrust blocking shall be formed and placed, so that joints and fittings will be accessible. In addition, all pressure pipe 12" in diameter and larger shall have mechanical restraint furnished and installed at all joints within 60 feet each way from any bend, in addition to thrust blocks shown in the drawings.

02224.3.4.3 VISUAL INSPECTION - The Contractor shall allow the Engineer to visually inspect every thrust block before it is buried.

02224.3.5 MANHOLE INSTALLATION

02224.3.5.1 BASES - Prior to setting the base for manholes, the bottom of the excavation shall be carefully graded to provide uniform bearing and support for the manhole. Where the manhole base is cast in place, all loose material shall be removed and excavation shall be made to assure placement is made on undisturbed soil. Where pre-cast bases for manholes are used, the trench shall be over-excavated at least 6-inches and filled with granular backfill as described herein and compacted and graded to provide uniform bearing and support for the manhole. Where manholes are installed on existing piping, the base may be formed by placing concrete around and under the existing pipe and then cutting away the top one-third of the pipe to form an open channel, after the concrete has been allowed to adequately cure (see invert channels below).

02224.3.5.2 INVERT CHANNELS - Invert channels shall be formed from concrete to conform in shape and slope to that of the sewer line. The depth of the channel shall be at least three-quarters that of the diameter of the sewer pipe it serves. Adjacent floor area shall be sloped towards the invert channel to provide a minimum slope of one-inch per foot.

02224.3.5.3 JOINTS AND CONNECTIONS - All joints between manhole components shall be made watertight with a permanently flexible sealant. Connections to manholes with new piping shall be made with a rubber boot or seal which will assure a flexible, watertight seal and which conforms to ASTM C923. The connector shall be of a size specifically designed for the pipe material and hole size placed in the wall of the manhole.

02224.3.5.4 DROP MANHOLES - Drop sewer manholes shall be constructed in accordance with the details shown on the drawings, whenever a grade difference of more than 18-inches occurs in that manhole. For grade differences of less than 18-inches, the flowline of the manhole base shall be sloped to provide a smooth transition between incoming and outgoing sewer lines.

02224.3.6 FLUSHING AND CLEANING

Prior to proceeding with testing, all sewer lines, manholes, and structures and connected piping installed under this Contract shall be flushed and cleaned. The Contractor shall provide all labor, materials, cleaning equipment, and water required to clean the system components.

Upon approval of the Engineer, the Contractor can use standard wastewater system cleaning equipment and methods, such as high-pressure washer systems and suction truck systems, to clean sewer lines and manholes as an alternative to flushing as described below.

Before isolating a specific section of line for flushing, the Contractor shall be responsible for making the necessary arrangements and appropriate piping connections to safely discharge the water used for flushing, to avoid any property damage or contamination of bodies of natural surface or ground water. The Contractor shall fill each section to be tested with clean potable water and then flush the line. The Contractor shall make the necessary arrangements so that a 2.5-foot per second flow velocity will be established in the lines during flushing. Flows required to produce the required flushing velocity indicated above are provided as follows:

FLUSHING FLOW AND VELOCITY

Pipe Diameter (inches)	Flow (gpm) to Produce 2.5 fps
4	100
6	200
8	400
10	600
12	900
16	1600

NOTE: With 40 psi residual pressure, 2 1/2 inch and 4-1/2 inch hydrant outlet nozzles will have the ability to discharge approximately 1,000 GPM and 2,500 GPM respectively.

02224.3.7 TESTING

02224.3.7.1 BACKFILL AND COMPACTION - No testing of any sewer line shall be performed until the trench has been backfilled and compacted to the appropriate unsurfaced grade or level.

02224.3.7.2 FORCE MAINS - Force mains shall be hydrostatically tested according to the requirements of AWWA - 600, Section 4, Hydrostatic Testing of Pipelines for Force Mains.

The Contractor shall furnish all necessary personnel, water, equipment, supplies, and plugging devices required to perform leakage tests as described therein. Any leaks or other deficiencies that are detected shall be repaired and the test section of pipe shall then be re-tested by the Contractor. This process shall be repeated until compliance is achieved.

02224.3.7.3 GRAVITY MAINS - All gravity main sewer piping shall be air pressure tested for exfiltration. Air pressure testing shall be accomplished in accordance with recommended practice (UNI-B-6) of the Uni-Bell PVC Pipe Association for all pipelines less than 36-inches in diameter. Pressure testing will be made at all joints for lines 36-inches or greater in diameter. Testing will be performed with equipment equivalent to that manufactured by Cherne Industrial, Inc. and consistent with the procedure described as follows:

- All wyes, tees, and/or ends of lateral stubs shall be suitably capped and braced to withstand the internal test pressure of the section being tested. Caps shall be easily removable for making future lateral or extension connections.

- Test sections of sewer line shall be isolated by plugging at each manhole with pneumatic plugs. One of the plugs shall be fitted with connections to allow the following:

  ⇒ Inflation of the pneumatic plug.
  ⇒ Pressure measurement inside the isolated section of sewer line.
  ⇒ Introduction of air under pressure into the isolated section of sewer line.

- Air for pressurizing and gauges for measuring pressures shall be supplied through and incorporated into a control panel manufactured specifically for such testing. The control panel shall be fitted with a 3 1/2-inch (or larger), 0 to 30-psi gauge for reading the internal line pressure. Calibrations on the gauge for the 0 through 10-psi range shall be in tenths of pounds.

- Personnel will not be allowed in any involved manhole while pressure is being applied to a test section.

- Air shall be introduced into the test section until the pressure stabilizes at 3.5 psi. Then the time required for the pressure to drop to 3.0 psi shall be observed, recorded, and compared to the following table of acceptability standards:

ALLOWABLE TIME FOR A 0.5 psig TEST PRESSURE DROP IN PVC SEWER PIPE

Pipe Diam. (inches)	Minimum Time in Minutes and Seconds for Various Lengths of Pipe							
	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
6	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
18	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51

If the level of any groundwater present is higher than the level of the test section, the test air pressure shall be increased until it is 4 psi greater than the average backpressure induced on the line by the ground water. At least two minutes shall be allowed for the interior air pressure to stabilize at that pressure. Pressure in the line then shall be observed until it has decreased to 3.5-psi above the groundwater backpressure. The foregoing described test for a 0.5-psi pressure drop can then be commenced.

- Exfiltration testing for all pipe and joints shall be considered acceptable when the time measured for pressure to decrease from 3.5 to 3.0 psi is equal to or greater than the time shown above in the table.

Infiltration testing also shall be conducted for all gravity main sewer lines when the groundwater level is above the top of the pipe section being tested. Tests shall be made by observing and measuring the amount of water infiltration. Testing shall be conducted from manhole to manhole. The length of pipe to be tested shall not exceed 700 feet. The following steps shall be taken as the testing proceeds:

- Measurement of ground water elevation shall be made at the upper and lower ends of the test section and recorded. The upper end of the test section shall then be plugged and the flow of water leaving the lower end will be measured, either by directing the flow into a container of known volume or by observation of flow over a weir.

- Acceptance of the test section for infiltration compliance will be given when the rate of flow out of the section is less than 200 gallons per inch of internal pipe diameter per mile per 24-hour day.

All manholes shall be checked for infiltration by observing their interior surfaces for signs of water infiltration.

02224.3.7.4 DEFLECTION TESTING - All flexible wall sewer piping shall be tested for deflection by passing a mandrel sized to pass through a 5-percent deflection (or deformation) of the pipe section being tested. The Engineer may waive this requirement on short footage projects. Requirements for making such tests are provided as follows:

- Deflection testing shall not be conducted until backfill in the trench has been in place for at least 30 days.

- The test shall be performed by moving the mandrel through the test section without the aid of a mechanical pulling device.

- The mandrel shall be fitted with an odd number of fins or legs (at least nine) which are not worn sufficiently to affect the mandrel's diameter. The fins shall be sized to fit the specific type and size of pipe being tested and shall be stamped by the manufacturer to identify the type and size of pipe. When requested, the Contractor shall provide proof rings to check the mandrel's diameter. The length of the contact edge of the fins shall be at least equal to the pipe's nominal diameter.

- Acceptance of the test section of pipe will be given when the mandrel can pass through that section without stoppage. If stoppage occurs, the pipe shall be excavated and exposed for examination to determine if damage to the pipe has taken place. When pipe damage has occurred, the damaged section shall be removed and replaced by the Contractor. If an obstruction has been caused by deflection, but the pipe is undamaged, the Contractor shall replace the bedding as necessary and carefully re-compact the bedding and backfill. When such corrective measures are completed, the mandrel shall be passed through the test section again to assure compliance.

02224.3.7.5 TESTING DOCUMENTATION - The Contractor shall maintain a record of the procedures performed and the test results for all tests performed on pipelines installed under this Contract. Information contained on the record shall include the following:

- Identification of Contract.
- Contractor's name and name of testing entity, if performed by other than Contractor.
- Name of Test Supervisor.
- Date of test.
- Type of test (air pressure, infiltration, deflection, etc.).
- Identification of test section which includes location, size, and type of pipe.
- Test results (pass/fail, amount of leakage, etc.).
- Description of failure, if any, including reason for failure and corrective measures taken.
- Signature of Test Supervisor.
- Approval signature of Engineer or Engineer's Representative witnessing the tests.

Photocopies of the test documentation shall be provided to the Engineer within 48 hours after the tests are performed and acceptance of the test section is achieved.

02224.3.8 PIPELINE LOCATION IDENTIFIERS

The Contractor shall furnish and install all pipeline location identifiers as called for on the Plans.

02224.3.9 CLEANUP

Following acceptance of testing and completion of backfilling and surface restoration, the Contractor shall prepare the work for contract closeout in accordance with Section 01200 of these Specifications.

02224.4 METHOD OF MEASUREMENT

02224.4.1 PIPE AND APPURTENANCES

This measurement shall be made using a tape measure or other accurate measuring device to determine the total number of lineal feet of pipe in place and accepted. Measurement of pipe shall be made from inside of manhole connection to inside of manhole connection, or to the outside of other structures, and shall include the lineal measurement of valves, fittings, pipe within casings, etc., that occur in the line. This measurement also shall include all work items necessary to completion of the sewer system such as trench excavation, backfilling, compaction, and testing, as well as "furnish and install" or "install only" items such as pipe and fittings, location markers, tracer wire, and warning tape as required on the Drawings.

02224.4.2 MANHOLES

Measurement of manholes shall be made by counting the number of manholes of each of the sizes (diameters) indicated on the Drawings, with drop piping, that have been installed and accepted. Variations in the vertical depth of manholes will not be taken into consideration.

Measurement of drop manholes shall be made in the same manner and shall include the drop piping and appurtenances required for making the drop.

As with pipe, measurement for all manholes shall include all work and materials necessary for the finished, functional, and accepted construction of the manhole.

02224.4.3 CONNECTIONS TO EXISTING WORK

Measurement for connections to existing pipe, manholes, or other structures shall be made by counting the number of each type or size of connection made and accepted, as indicated on the Drawings.

02224.4.4 SERVICE TAPS

Measurement for service taps shall be made by counting each connection made to a sewer main. Such measurement shall include furnishing and installing the connection fitting, including all labor and materials required to cut and install the fitting to the main, and for the marker placed on the upstream end of the service lateral.

02224.4.5 SERVICE STUBS

A tape measure or other accurate measuring device shall be used to determine the number of lineal feet of service stub in place and accepted, measuring from the fitting on the main sewer line (service tap) to the termination point of the service stub at the property line.

02224.4.6 SERVICE LATERALS

A tape measure or other accurate measuring device shall be used to determine the number of lineal feet of service lateral, measuring from the end of the service stub at the property line to the termination point of the lateral as constructed in the field.

02224.5 BASIS OF PAYMENT

02224.5.1 The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
(*Size*)(*Type*) Sewer Pipe	Lineal Foot
(*Size*) Manhole	Each
(*Size*) Drop Manhole	Each
(*Size*) Connection to Existing (*Structure)*	Each
Service Tap	Each
(*Size*)(*Type*) Service Stub	Lineal Foot
(*Size*)(*Type*) Service Lateral	Lineal Foot

02226.1 DESCRIPTION

Includes furnishing all labor, equipment and materials required to install pipe, dispose of unsuitable materials, perform trench backfilling and compaction in conformance with Section 02200 and provide pavement restorations in conformance with Section 02500.

02226.1.1 RELATED WORK

Section 02105 - Earthwork Materials
Section 02200 - Trench Excavation and Backfill
Section 02500 - Removal and Replacement of Surface Improvements

02226.1.2 SUBMITTALS

Submit manufacturer's certification that all material furnished is in compliance with specifications, standard references, and contract requirements in accordance with Section 01300.

02226.1.3 DEFINITIONS

Pipe Zone - The area around the pipe in the trench width and up to 12-inches over the pipe.

Drainage Pipe - Perforated and non-perforated pipe used for collection and transmission of subsurface drainage.

Culvert - Pipe used for transmission of surface water under and around roadways.

02226.2 MATERIALS

The Contractor shall not change pipe size, material or class without written approval from the Engineer. Provide the type, class and size of pipe shown on the Drawings and conforming to the following:

02226.2.1 REINFORCED CONCRETE PIPE

Use Class A or B with Type II cement, which conforms to AASHTO M-170. Elliptical pipe shall be Class A or B, which conforms to AASHTO M-207 with tongue and grove joints.

02226.2.2 CORRUGATED POLYETHYLENE CULVERT PIPE

Corrugated polyethylene culvert pipe shall be Class A or B conforming to the requirements of AASHTO M-294.

02226.2.3 CORRUGATED GALVANIZED STEEL PIPE AND PIPE-ARCH

Corrugated galvanized steel pipe and pipe-arch shall be Class A, B or C, which conforms to the requirements of AASHTO M-36.

02226.2.4 CORRUGATED ALUMINUM PIPE AND PIPE-ARCH

Corrugated aluminum pipe and pipe-arch shall be Class A, B or C, which conforms to the requirements of AASHTO M-196 and M-197.

02226.2.5 PVC DRAIN PIPE

Solid wall and perforated drain pipe with rubber gasketed joints, which conforms to the requirements of ASTM D2729. Perforation shall follow the ASTM D2729 perforation pattern of 2, one-half inch holes 120º apart with 5-inch spacing.

02226.2.6 PE DRAIN PIPE

Corrugated solid wall and perforated drainpipe with rubber gasketed joints, which shall conform to ASTM F405.

02226.2.7 DRAIN GRAVEL

Drain Gravel shall comply with the requirements provided in Section 02105.

02226.2.8 GEOTEXTILE FABRIC

Geotextile Fabric shall be as called for on the Drawings and specified in Section 02950.

02226.3 CONSTRUCTION REQUIREMENTS

02226.3.1 HANDLING AND STORAGE OF PIPE

The Contractor shall handle and store pipe to prevent damage by crushing or piercing and in such a way as to prevent contamination. Any pipe delivered to the Work site, which does not conform to specifications or is scratched, bent, cracked, chipped or otherwise damaged, shall be rejected. The Contractor shall protect pipe and components against dirt and damage during shipment and storage and shall store pipe in strict conformance with the manufacturer's recommendations. The Contractor shall not store PE or PVC plastic pipe in direct sunlight for more than 30 days.

02226.3.2 PREPARATION

The Contractor shall verify location of existing utilities and structures ahead of pipe laying operation. If pipe adjustment is necessary due to location of other utilities, secure approval from Engineer prior to proceeding.

02226.3.3 TRENCHWORK

The Contractor shall excavate trenches in accordance with Section 02200. The Contractor shall repair unstable subgrade for pipe installation by over-excavating to stable soils or a minimum 8-inches depth and replace with approved stabilization material.

02226.3.4 DEWATERING

The Contractor shall keep the pipe trenches free from water during pipe installation by a method acceptable to the Engineer.

The Contractor shall be responsible for damages of any nature resulting from the dewatering operations, notwithstanding approval of the method by the Engineer.

02226.3.5 SHORING

The Contractor shall provide trench shoring and protection in accordance with applicable OSHA standards and Section 01510.

02226.3.6 INSTALLATION

02226.3.6.1 PLACEMENT – Pipe placement shall be as follows:

- The Contractor shall handle and install pipe as per manufacturer's specific instructions.
- The Contractor shall make bellholes and depressions only of such length, depth and width as required for properly accommodating the particular type of pipe joint being installed.
- The Contractor shall join pipe in accordance with manufacturer's recommendation or as specified in piping specification section.
- Pipelines shall be laid on uniform grades.
- Do not install pipe at a grade less than 0.5%.
- Lay gravity flow pipe upgrade beginning at lower end.
- Pipe shall not be installed without continuous support under the barrel.
- The Contractor shall obtain written approval from the Engineer to deflect pipe from true line and grade. Do not exceed deflection allowed by pipe manufacturer's recommendation.
- The Contractor shall not lay pipe in water or when trench conditions or weather are unsuitable for such work.
- The Contractor shall place circular concrete pipe which contains elliptical reinforcing so that the reference lines designating the top of the pipes will not be more than 5° from the vertical plane through the longitudinal axis of the pipe.
- Not more than 300 feet of continuous pipe placement will be allowed without the installation of an inlet box, catch basin, combination box, clean-out box, manhole or other such structure.

02226.3.6.2 CUTTING TOOL - The Contractor shall use an approved machine or cutting tool recommended by the pipe manufacturer to cut pipe.

02226.3.6.3 DAMAGED PIPE - The Contractor shall remove and relay any section of pipe already placed which is found to be out of alignment, defective or damaged.

02226.3.6.4 PLUGS - The Contractor shall provide plugs for pipeline branches, stubs or other open ends, which are not to be immediately connected. The Contractor shall use a joint comparable to the main line joints and thrust block as required to secure plugs.

02226.3.6.5 GALVANIZED PIPE - The Contractor shall provide protection to galvanized pipe to prevent scratches or abrasion and assure that the coating is not damaged. Remove and replace damaged pipe sections when directed by the Engineer. Provide proper facilities for lowering sections of pipe into trenches.

02226.3.6.6 CONNECTION TO CONCRETE - The Contractor shall form, size and finish structures connecting piping in accordance with the details of the Drawings and Section 03100. The Contractor shall install mortar in joints at catch basins, clean-outs, manholes, etc. Remove all loose material and soil from the surface on which concrete will be placed. Non-metallic pipe shall be thoroughly wetted prior to pouring the collars.

02226.3.6.7 PIPE BEDDING - Unless otherwise shown on these Contract Documents, culverts shall be bedded with on site bedding materials or imported bedding, which conforms to Section 02105. Drainage piping shall be bedded in accordance with the details shown on the Drawings with material which also conforms to Section 02105.

02226.3.6.8 BACKFILL - The Contractor shall compact trench backfill in accordance with the requirements of Section 02200 and 02222.

02226.3.7 INSPECTION

Prior to starting backfill of trenches, the Contractor shall notify the Engineer of completion of pipe laying and allow the Engineer to check all installed drain piping and culverts. When access to installed pipe is determined necessary for checking by the Engineer, the Contractor shall open any covering as requested. If defects are found, the Contractor shall make the necessary corrections at no cost to the Owner. If no defects are found, the cost of uncovering and recovering shall be an additional expense covered by the Owner in accordance with the General Conditions (Section 00700).

02226.4 METHOD OF MEASUREMENT

02226.4.1 PIPE AND CULVERTS

Measurement of drainage piping and culverts shall be made by using a tape measure or other accurate measuring device to determine the number of lineal feet of pipe or culvert, along the centerline of the pipe, installed and accepted. This measurement shall include the lengths of all in-line fittings and shall stand as the measurement of all other work involved with the pipe installation such as trenching, backfilling, and site restoration as required.

02226.4.2 ENTRANCE AND EXIT STRUCTURES

Measurement of culvert or drainage pipe entrance and exit structures and measurement of culvert end sections shall be separate from the lineal measurement of the pipe and shall be made by counting the number of such structures built and accepted.

02226.4.3 OTHER WORK AND MATERIALS

The method of measurement for other work and materials such as drain rock, geotextile fabric, and import bedding and backfill will be described separately when called for on the Drawings, in these Specifications, or required by the Engineer.

02226.4.4 DEWATERING

Dewatering of trenches is considered incidental to the construction. The Contractor shall include all associated costs for trench dewatering in the lump sum contract price.

02226.5 BASIS OF PAYMENT - The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
(15-Inch, CMP) Culvert Pipe	Lineal Foot
(Diameter, Type) Drain Pipe	Lineal Foot
Entrance/Exit Structures	Each
Culvert End Section	Each

Payment for other materials, (i.e., drain rock, imported bedding and backfill, geotextile fabrics, etc.) will be made in accordance with their respective specification requirement.

SPECIAL PROVISION

CLAY CUTOFF WALL	SECTION SP02250

02250.1 DESCRIPTION

This section describes the construction and installation of clay cutoff walls in trench excavations to inhibit the movement of groundwater and/or to prevent the drainage of wetlands or other surface water features following backfill.

02250.2 MATERIALS

Clay used for construction of the clay cutoff wall shall be pit run material and of a silty clay exhibiting a permeability of $1X10^{-6}$ cm/sec.

02250.3 CONSTRUCTION REQUIREMENTS

The Contractor shall furnish and install clay cutoff wall for backfill in trenches where influenced by groundwater or otherwise indicated on the plans. The clay cutoff wall shall act as a flow curtain to stop groundwater piping in trenches and along pipelines.

02250.3.1 INSTALLATION

Clay cutoff wall shall be installed the total trench width from the bottom of the trench to 2 feet above groundwater static level or finished grade, whichever is lower. Clay cutoff walls shall be a minimum of 4 feet thick. Clay cutoff walls shall be constructed at each end of the water bearing portion of a trench excavation and at intermediate intervals not to exceed 400 feet where groundwater exists

02250.3.2 COMPACTION

Material shall be compacted to 90% maximum density. Proctors shall be taken for materials used, furnished by the Contractor's independent geotechnical testing laboratory, or by the supplier of approved clay.

02250.3.3 PIPE BEDDING

Clay shall be used to bed pipe, and shall be installed as specified herein for "pipe bedding".

02250.3.4 FINISH

Finished grade and surface improvements over clay cutoff walls shall be as specified herein and shown on the drawings.

02250.4 METHOD OF MEASUREMENT

Measurement for this bid item shall be made by counting the number of completed and accepted clay cutoff walls installed in the project.

02250.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Clay Cutoff Wall	Each

SPECIAL PROVISION

CASING PIPE INSTALLATION BY BORING AND JACKING — SECTION SP02315

02315.1 DESCRIPTION

This section covers the installation of casing pipe in certain situations where the casing pipe is required for safety considerations and/or where it is not possible to install either the casing or the carrier pipe by means of open trench excavation.

02315.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 01510 - Protection of Existing Properties
Section 02200 - Trench Excavation and Backfill
Section 02222 - Waterline Pipe Installation
Section 02224 – Sewer Line Pipe and Manhole Installation
Section 15110 – Pipe and Piping Systems

02315.1.2 SUBMITTALS

Prior to commencing any operations, the Contractor shall submit a complete list of all materials to be used in the work, in accordance with Section 01300. The submittal shall include detailed descriptions and/or drawings which show the pit dimensions, pit bracing, casing pipe, casing spacers, jacking equipment, and method of installing the carrier pipe.

02315.1.3 DEFINITIONS

Casing Pipe - the pipe which is installed to provide a conduit for installation of the carrier pipe within.

Carrier Pipe - the pipe installed inside the casing pipe.

Boring - the procedure used to create an opening in the earth materials in which the casing pipe will be inserted.

Jacking - the procedure used to force the casing pipe into the opening in the earth materials.

Spacers - the devices used to align and support the carrier pipe inside the casing during its placement and when the placement is complete.

02315.2 MATERIALS

02315.2.1 CASING PIPE

Only welded steel pipe shall be installed as casing pipe under this section. The pipe shall be ASTM A53, Grade B, which conforms to ANSI/AWWA C200. The minimum 48-inch casing diameter and 1-inch wall thickness shall be as shown on the plans.

The Contractor may select a greater pipe diameter or wall thickness to accommodate the method of installation, loading involved, site conditions, and possible interference; however, such selection will be made at no additional cost to the Owner. In all cases, the inside diameter of the casing pipe shall be large enough to contain the carrier pipe and approved casing spacers and other required materials and equipment.

02315.2.3 CASING SPACERS

Casing spacers shall be commercially available spacers such as are supplied by Advance Products & Systems of Lafayette, Louisiana; Cascade Waterworks Manufacturing Company of Yorkville, Illinois, or approved equal. Unless required otherwise in the Contract Documents, casing spacers shall be manufactured of stainless steel with polymer bearing surfaces on the runners. They shall be of bolt-on design with a two-piece shell, and shall be installed in accordance with manufacturer's instructions. The spacers shall provide electrical isolation between the casing pipe and the carrier pipe.

02315.2.4 SAND

When called for in the Contract Documents, sand to be used to fill the annular space between the carrier pipe and the casing pipe shall be clean and free of lumps, with 100 percent passing a standard No. 30 sieve.

02315.2.5 CARRIER PIPE

Specifications for the carrier pipe and its appurtenances are given elsewhere in the Contract Documents, particularly in Section 15110 and on the Drawings.

02315.2.6 CAPPING MATERIAL

Temporary casing pipe plugs or end caps may be fabricated from 3/4 inch (minimum) C-DX plywood treated for exterior use, or other suitable material as allowed by the Engineer.

02315.2.7 END SEALS

Carrier pipe to casing pipe end seals shall be installed on both ends of the casing and shall be appropriately sized for the application. Seals shall be as manufactured by Pipeline Seal & Insulator, Inc., or approved equal. Seals shall be of synthetic rubber with stainless steel bands and clamps, suitable for permanent installation in the ground.

02315.3 CONSTRUCTION REQUIREMENTS

The casing pipe installation shall be installed under the conditions of the WYDOT license obtained by the owner for this work. Clearances, barriers, warning signage shall conform to the MUTCD.

02315.3.1 GENERAL

The Contractor shall furnish all materials and labor to place a casing pipe underground and install pipelines in such casing in accordance with the Contract Documents. The casing pipe will be installed by boring, jacking, hammering, or other method as prescribed in the Contract Documents and/or approved by the Engineer.

02315.3.1.1 EXPERIENCE - The Contractor shall have at least 5 years experience with jacking or boring casing pipe installations. If the Contractor does not have the required experience, he may, upon the approval of the Engineer, retain the services of a subcontractor who is qualified to perform this work.

02315.3.1.2 NOTIFICATION AND VISUAL INSPECTION - At least 3 days notice shall be given to the Engineer prior to the start of any casing pipe installation operations. All boring and jacking work

shall be performed in the presence of the Engineer, unless the Engineer has granted prior approval to perform such work in its absence.

02315.3.1.3 REGULATORY COMPLIANCE - The Contractor shall comply with the requirements of any affected public agency, railway company, utility company or other applicable affected agency responsible for public safety or improvements which might be endangered by the casing installation.

02315.3.1.4 TRAFFIC CONTROL - In the event that the Contractor is not ready to install the carrier pipe and its appurtenances at the time of completion of installation of the casing pipe, and the operation is inhibiting roadway traffic flow, the earth face at the entrance and terminal shall be supported with plywood bulkheads and the approach trenches will be backfilled. Temporary surfacing shall be placed thereon and the affected portion of the street will then be reopened to traffic. Approach trenches in public streets shall not be permitted to remain open for extended periods of time.

02315.3.2 INSTALLATION

02315.3.2.1 PIT EXCAVATION - The pit excavations for boring or jacking operations shall be adequately shored to safeguard existing substructures and surface improvements and to ensure against ground movement in the vicinity of the jack supports. The Contractor shall provide adequate space within the excavation to permit the insertion of the lengths of casing to be installed. Additional soil stabilization and special bracing measures may be required due to poor soil or weak saturated soils in this area.

02315.3.2.2 WELDERS' QUALIFICATIONS - All welding shall be done by welders qualified under the provisions of ANSI/AWS D1.1. Qualification shall have been performed by an approved, independent, testing agency not more than 6 months prior to commencing work. Welding machines and electrodes similar to those to be used on the Project shall have been used in the qualification test. The Contractor shall furnish all material and bear the expense of qualifying welders.

02315.3.2.3 JOINING – Casing pipe section joints shall be butt-welded, unless otherwise approved by the Engineer. Casing pipe ends on both sides of the joint shall be prepared in conformance with the requirements of ANSI/AWS D1.1.

02315.3.2.4 PROTECTION OF CASING PIPE - The Contractor shall protect and preserve the interior surfaces of the casing pipe from damage. As required by the Engineer, the Contractor shall provide and install temporary plugs or end caps on casing pipe to prevent the entrance of insects, animals, water, rock, dirt, or other deleterious material during the time casing pipe ends are left exposed while other work is being done.

02315.3.2.5 JACKING AND BORING - For jacking operations, a steel jacking head shall be fitted in such a manner that it extends around the entire outer surface and projects at least 18-inches beyond the driving end of the steel casing. The jacking head shall not protrude more than ½-inch outside the outer casing surface. The head shall be securely anchored to the casing to prevent any alignment variation during jacking operations.

In opening the hole, the Contractor shall restrict excavation of materials to provide the least clearance necessary to prevent binding, to avoid loss of soil, consequential settlement, and possible damage to overlying structures. To minimize the potential for voids outside the casing, excavation shall be carried out entirely within the jacking head and not in advance of the head. Excavated materials shall be removed from the casing as the installation of the casing progresses. Accumulation of excavated materials within the casing will not be permitted without approval of the Engineer.

The Contractor shall control the application of the jacking pressure and excavation of materials ahead of the casing as it advances to prevent the casing from becoming earthbound or deviating from the required line and grade. Heavy guide timbers, or structural steel or concrete cradles, shall be used to ensure boring and/or jacking alignment. Timbers and structural steel sections shall be anchored to ensure action of the jacks is in line with the axis of the casing. A bearing block, consisting of a timber or structural steel framework, shall be constructed between the jacks and the end of the casing to provide uniform end bearing over the perimeter of the casing to distribute the jacking pressure evenly. In installing the casing pipe, it shall be the Contractor's responsibility to obtain the required alignment and grade for the carrier pipe and to ensure that the carrier pipe does not rest on the casing bottom.

After all equipment and excess excavated materials from the boring and jacking operations have been removed from the jacking pit, the Contractor shall prepare the bottom of the pit to serve as a pipe trench bottom in accordance with Section 02200. In doing this, all loose and disturbed materials below pipe grade shall be removed to the level of undisturbed earth, replaced in lifts, and each lift compacted to the appropriate density.

02315.3.2.6 CARRIER PIPE - Upon completion of casing pipe installation, the Contractor shall proceed with installation of the carrier pipe and area cleanup.

The carrier pipe MUST be installed in the casing in such a manner that sufficient carrier pipe extends from each end of the casing pipe to allow for appropriate joining and so as not to interfere with other work such as filling of the annular space. For this purpose, the Contractor shall leave a minimum of 5 feet of carrier pipe exposed at each end of the casing or as otherwise directed by the Engineer.

Mechanical restraint shall be installed on every joint of rubber gasket (slip) jointed carrier pipe installed in the casing pipe.

When required, testing of the carrier pipe shall be completed prior to the filling of the annular space between the casing and carrier pipe with sand. Testing of the carrier pipe shall be made in conformance with specifications outlined in Sections 02222 and 02224.

02315.3.2.7 END SEALS – As shown on the Drawings and/or required in the Special Provisions, the Contractor shall furnish and install permanent casing pipe to carrier pipe end seals. The Contractor shall coordinate this work to assure that seals are appropriately installed as the carrier pipe is placed in the casing pipe and before any backfill operations are started.

02315.3.2.8 FILLING OF ANNULAR SPACE - When required, the Contractor shall furnish all necessary sand, equipment, hoses, valves, fittings and labor to backfill the annular space in the casing with sand after the carrier pipe has been installed. Sand shall be conveyed through a hose and deposited in its final position by air pressure in such a manner as to completely fill all voids. Sand backfill will be considered completed when no more sand can be forced into the annular space.

02315.4 METHOD OF MEASUREMENT

The amount of casing pipe required shall be as shown on the drawings or prescribed elsewhere in the Contract Documents. However, casing pipe installation is not a "Lump Sum" item, and, in the event the actual quantities required differ from the amount shown, the difference in lineal feet, either more or less, shall be determined using a tape measure or other accurate measuring device and the Contractor paid according to the unit price on the Bid Schedule. The measurement for casing pipe shall include all other work and materials required to install the casing pipe and the carrier pipe within, such as all excavation including but not limited to boring and catch pits, carrier

pipe spacers, sand, backfill, bulkheads, soil stabilization, jack bracing, equipment and site clean-up.

Measurement for payment of the corresponding length of carrier pipe shall not be included in the casing pipe measurement. It shall be paid separately.

02315.5 BASIS OF PAYMENT

The accepted quantity will be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Boring and Jacking *(48-inch, 1-inch wall casing)*	Lineal Foot

CASING PIPE INSTALLATION BY OPEN TRENCH — SECTION 02320

02320.1 DESCRIPTION

This section covers the installation of casing pipe where the casing pipe is required for safety or other reasons but may be installed by open trench excavation.

02320.1.1 RELATED WORK

Section 01300 - Submittals
Section 01510 - Protection of Existing Properties
Section 02105 - Earthwork Materials
Section 02200 - Trench Excavation and Backfill
Section 02222 - Water Pipe Installation
Section 02224 - Sewer Pipe and Manhole Installation

02320.1.2 SUBMITTALS

Prior to commencing any operations, the Contractor shall submit a complete list of all materials to be used in the work, in accordance with Section 01300. The submittal shall include detailed descriptions and/or drawings which show the casing pipe, casing spacers, and method of installing the carrier pipe.

02320.1.3 DEFINITIONS

Casing Pipe - the pipe which is installed to provide a conduit for installation of the carrier pipe within.

Carrier Pipe - the pipe installed inside the casing pipe.

Spacers - the devices used to align and support the carrier pipe inside the casing during its placement and when the placement is complete.

02320.2 MATERIALS

02320.2.1 CASING PIPE

Casing pipe to be installed in open trenches shall be corrosion resistant concrete, PE, PVC or galvanized steel pipe of the size, class and configuration shown on the Drawings, or prescribed in the Special Provisions.

02320.2.2 CARRIER PIPING

Pipe installed in casing pipe shall be of the size, type and configuration shown on the Drawings, and/or prescribed in the Special Provisions. Mechanical restraints, suitable with the type of joints required for the carrier pipe, shall be provided with the carrier pipe.

02320.2.3 CASING SPACERS

Casing spacers shall be commercially available spacers such as are supplied by Advance Products & Systems of Lafayette, Louisiana, Cascade Waterworks Manufacturing Company of Yorkville, Illinois, or approved equal. Unless required otherwise in the Contract Documents, casing spacers shall be manufactured of stainless steel with polymer bearing surfaces on the runners. They shall be with a bolt-on design with a two piece shell, and shall be installed in accordance with manufacturer's instructions.

02320.2.4 SAND

When called for to be installed in the annular space around the carrier pipe, sand shall be clean and free of lumps, with 100 percent passing a standard No. 30 sieve.

02320.2.5 CONCRETE

Shall be Class 2000 as described in Section 3050 when used as encasement and Class 3500 when used as entrance or exit protective structures to any encasement.

02320.2.6 CONCRETE REINFORCEMENT

Shall be materials conforming to, and placed in accordance with. Section 03200 and the details shown on the Drawings.

02320.2.7 CAPPING MATERIAL

Temporary casing pipe plugs or end caps may be fabricated from 3/4 inch (minimum) C-DX plywood treated for exterior use, or other suitable material as allowed by the Engineer.

02320.2.8 END SEALS

Carrier pipe to casing pipe end seals shall be installed on both ends of the casing and shall be appropriately sized for the application. Seals shall be as manufactured by Pipeline Seal & Insulator, Inc., or approved equal. Seals shall be of synthetic rubber with stainless steel bands and clamps, suitable for permanent installation in the ground.

02320.3 CONSTRUCTION REQUIREMENTS

02320.3.1 GENERAL

The Contractor shall furnish all materials and labor to place a casing pipe underground and install pipelines in such casing in accordance with the Contract Documents. The casing pipe will be installed by open trenching as prescribed in the Contract Documents and/or approved by the Engineer.

02320.3.1.1 NOTIFICATION AND VISUAL INSPECTION - At least 3 days notice shall be given to the Engineer prior to the start of any casing pipe installation.

02320.3.1.2 REGULATORY COMPLIANCE - The Contractor shall comply with the requirements of any affected public agency, railway company, utility company or other applicable affected agency responsible for public safety or improvements which might be endangered by the casing installation

02320.3.1.3 TRAFFIC CONTROL - In the event that the Contractor is not ready to install the carrier pipe and its appurtenances at the time of completion of installation of the casing pipe, and the operation is inhibiting roadway traffic flow, the earth face at the entrance and terminal shall be supported with bulkheads and the approach trenches will be backfilled. Temporary surfacing shall be placed thereon and the affected portion of the street will then be reopened to traffic. Approach trenches in public streets shall not be permitted to remain open for extended periods of time.

02320.3.2 INSTALLATION

02320.3.2.1 EXCAVATION - The Contractor shall prepare the bed for the casing pipe by excavating in to the lines and grades shown on the Drawings in accordance with Section 02200. Laying of the casing pipe shall then be made in accordance with Section 02222 or 02224 as applicable according to the type of pipe required.

02320.3.2.2 CASING PIPE - The casing pipe shall be completely installed and backfilled, unless directed otherwise by the Engineer, before installation of the carrier pipe is started. It shall be the Contractor's responsibility to obtain the required alignment and grade for the carrier pipe and to ensure that the carrier pipe does not rest on the casing bottom.

When the ends of plastic casing pipe are left exposed for future insertion of carrier pipe, galvanized corrugated steel pipe of the appropriate diameter shall be slid over the end of the carrier pipe. The galvanized pipe shall be of sufficient length to cover the end of the plastic casing to a minimum of one foot and to extended from the end of the casing to daylight from beneath the earth cover.

02320.3.2.3 PROTECTION OF CASING PIPE - The Contractor shall protect and preserve the interior surfaces of the casing pipe from damage. As required by the Engineer, the Contractor shall provide and install temporary plugs or end caps on casing pipe to prevent the entrance of insects, animals, water, rock, dirt, or other deleterious material during the time casing pipe ends are left exposed while other work is being done.

02320.3.2.4 END SEALS – As shown on the Drawings and/or required in the Special Provisions, the Contractor shall furnish and install permanent, casing pipe to carrier pipe end seals. The Contractor shall coordinate this work to assure that seals are appropriately installed as the carrier pipe is placed in the casing pipe and before any backfill operations are started.

02320.3.2.5 CONCRETE ENCASEMENT - When encasement in concrete is required, the Contractor shall set the carrier pipe in place in compliance with the Drawings and then form and place concrete encasement in accordance with the Drawings and with Sections 03050, 03100 and 03200 in these Specifications.

02320.3.2.6 CARRIER PIPE - Upon completion of the encasement, the Contractor shall proceed with installation and cleanup of the lines connecting the carrier pipe

Mechanical restraint shall be installed on every joint of rubber gasket (slip) jointed carrier pipe installed in the casing pipe.

The carrier pipe MUST be installed in the casing in such a manner that sufficient carrier pipe extends from each end of the casing pipe to allow for appropriate joining and so as not to interfere with other work such as filling of the annular space. For this purpose, the Contractor shall leave a minimum of 5 feet of carrier pipe exposed at each end of the casing or as otherwise directed by the Engineer.

Testing of that part of the carrier pipe to be encased shall be made at the same time as testing of contiguous portions of the carrier pipe. Testing shall conform to testing requirements stated in Sections 02222 and 02224 as appropriate. For concrete encasement, testing of the carrier pipe shall take place prior to the concrete being placed. For pipe encasement, testing shall be completed prior to the filling of the annular space between the casing and carrier pipe with sand.

After the carrier pipe has been tested and accepted, end seals or other approved covers shall be installed over the ends of the casing pipe to prevent foreign materials from entering the casing while backfilling takes place.

02320.3.2.7 FILLING OF ANNULAR SPACE - When required for pipe encasement, the Contractor shall furnish all necessary sand, equipment, hoses, valves, fittings and labor to backfill the annular space in the casing with sand after the carrier pipe has been installed. Sand shall be conveyed by air pressure through a hose and deposited in its final position in such a manner as to completely fill all voids. This work will be considered completed when no more sand can be forced into the annular space.

02320.4 METHOD OF MEASUREMENT

02320.4.1 METAL PIPE ENCASEMENT

The amount of casing pipe required shall be as shown on the drawings or prescribed elsewhere in the Contract Documents. However, casing pipe installation is not a "Lump Sum" item, and, in the event the actual quantities required differ from the amount shown, the difference in lineal feet, either more or less, shall be determined using a tape measure or other accurate measuring device and the Contractor paid according to the unit price on the Bid Schedule. The measurement for casing pipe shall include all other work and materials required to install the casing pipe and the carrier pipe within, such as all excavation including but not limited to boring and catch pits, carrier pipe spacers, sand, concrete, backfill, bulkheads, equipment and site clean-up together with all other materials and labor required for accepted installation. Measurement for pipe encasement includes backfilling of road sections to the top of the sub-grade.

02320.4.2 CONCRETE ENCASEMENT

Measurement of Concrete Pipe Encasement will be made by counting the number of cubic yards of concrete placed to encase the carrier pipe as required, and shall include forming, reinforcement, insertion of carrier pipe, and excavation and backfill of the trench. Measurement for concrete encasement includes backfilling of road sections to the top of the sub-grade.

02320.4.3 SEPARATE MEASUREMENTS

Measurement for payment of the length of carrier pipe within the encasement shall be separate from and in addition to measurement of the encasement. Measurement of base gravel and surfacing materials will be separate and according to bid items for those materials.

02320.5 BASIS OF PAYMENT

The accepted quantity will be paid for at the contract unit price for:

PAY ITEM	UNIT
Piped Encasement (casing size and type)	Lineal Foot
Concrete Pipe Encasement	Cubic Yard

Separate payment for furnishing and installing the carrier pipe shall be made under other bid items.

02500.1 DESCRIPTION

This work includes removal and restoration of existing features, public or private, including but not limited to asphalt or concrete pavement, concrete structures, curb and gutter, sidewalk, gravel surfacing, driveways, crosswalks, landscaping, field crops, irrigation ditches, fences, culverts, buried or exposed utilities, abandoned utilities, small utility buildings and the disposal of resulting waste materials and debris.

02500.1.1 RELATED WORK

Section 01510 - Protection of Existing Properties
Section 02015 - Clearing and Grubbing
Section 02200 - Trench Excavation and Backfill
Section 02511 - Hot Plant Mix Bituminous Surfacing
Section 02520 - Pavement Cutting
Section 02900 - Landscaping

02500.1.2 SUBMITTALS

When any improvement not owned by the Owner is designated for restoration work, then, upon completion of such restoration, the Contractor shall obtain a written statement of acceptance or release from the responsible owner of the feature. This statement, in turn, will be submitted to the Engineer for his review and approval prior to acceptance of the work for payment.

02500.1.3 DEFINITIONS

Not used.

02500.2 MATERIALS

02500.2.1 GENERAL

When restoration of a feature is indicated in the Contract Documents, such work shall be accomplished so as to restore the feature to its original, or better, condition and/or function as it existed prior to removal.

It is recognized that exact duplication of materials cannot always be achieved, but reasonable effort is expected from the Contractor to restore the feature with materials which will provide the same or better service and appearance as observed prior to removal.

All materials shall be new.

02500.2.2 BITUMINOUS SURFACE

02500.2.2.1 PRIMER OR TACKER COAT – Shall be an approved bituminous material such as type MC-70-250, SS1, or CS-1.

02500.2.2.2 PATCHING AND REPAIR - Plant mix material that meets or exceeds the requirements of Section 02511 herein, or of the local State Department of Transportation for asphalt surface road repair, shall be used for patching and repair.

02500.2.2.3 SURFACING – Shall be hot or cold mix bituminous surfacing, meeting or exceeding the requirements of Sections 02511 or 02512 herein, or of the local State Department of Transportation for asphalt surface road repair.

02500.3 CONSTRUCTION REQUIREMENTS

02500.3.1 UNCLASSIFIED REMOVAL AND RESTORATION

02500.3.1.1 EXISTING IMPROVEMENTS - All existing facilities disturbed by the Contractor in prosecution of the Work, including but not limited to asphalt or concrete pavement, concrete structures, curb and gutter, sidewalk, gravel surfacing, driveways, crosswalks, landscaping, field crops, irrigation ditches, fences, culverts, buried or exposed utilities, abandoned utilities, small utility buildings or any other structures or obstructions designated to be removed on the Drawings, by the Engineer, or these Specifications, shall be removed, cleaned up, and then restored or replaced in kind by the Contractor in new condition.

02500.3.1.2 ADJACENT IMPROVEMENTS - Care shall be exercised in such removal to assure that adjacent facilities or structures, which are to remain, are not disturbed. Any damage to such existing facilities or structures resulting from carelessness or negligence on the Contractor's part shall be satisfactorily restored to new condition at the Contractor's expense.

02500.3.1.3 VEGETATION - Trees, shrubs, and other landscape plants designated to be saved for replanting shall be carefully removed, bundled, set aside and protected for replanting by the Contractor. Turf Sod to be saved for replanting shall be removed by machine cutting. In lieu of removal and replacement of turf sod or field crops, the Contractor may, upon approval of the property owner, remove and replant the same. Such agreements shall be documented on the final property release to be signed by the property owner.

Replanting of landscape items shall be performed in accordance with Section 2900.

02500.3.2 TOPSOIL

02500.3.2.1 REMOVAL AND PROTECTION - In all construction areas where re-growth of vegetation is desired, and when called for by the Contract Documents, the Contractor shall remove, segregate, stockpile, store, and protect topsoil during excavation in accordance with Section 02900. Topsoil shall be kept free from contamination from foreign materials and other soils. The Contractor shall arrange construction activities to avoid damage or disturbance to the stockpiled soil.

02500.3.2.2 REPLACEMENT - When backfill operations have been completed, the topsoil shall be replaced and restored to the original contours or as called for on the Drawings, in accordance with Section 2900 of these Specifications.

02500.3.3 GRAVEL SURFACE

02500.3.3.1 REMOVAL - When restoration of graveled driveways, roadways, or parking areas is required, the existing gravel surfacing shall be graded off and stockpiled safely away from ongoing work activities, to prevent contamination with subsurface materials. It may then be reapplied and compacted during restoration activities.

02500.3.3.2 RESTORATION - Areas to be restored shall be backfilled and graded to uniform lines and compacted to the density prescribed for trenching in Section 02200. Existing gravel surfacing materials shall then be replaced in uniform 3 inch layers compacted to 95% of maximum density. After compaction, the affected area shall be graded smooth. Sufficient new material of equal or better quality shall be applied and mixed in, to replace materials lost during prosecution of the Work, to ensure a 3-inch minimum gravel cover after compaction and grading.

02500.3.4 BITUMINOUS SURFACE

02500.3.4.1 REMOVAL - Bituminous pavement surface shall be removed and restored in accordance with this paragraph unless provisions for restoration are made in other Sections of these Specifications. The pavement surface, public or private, designated for removal shall be removed to neat lines, which shall be cut in accordance with Section 02520. No ripping or rooting will be permitted outside of the limits of the cut lines.

Existing driveways, sidewalks, etc., which do not match the new finish grade as shown on the Drawings, also shall be removed preparatory to restoration work.

02500.3.4.2 DISPOSAL - Surfacing materials removed shall be disposed of in accordance with Section 1520 of these Specifications, and will not be permitted in the backfill, except as specifically authorized by the Engineer and in accordance with local requirements.

02500.3.4.3 RESTORATION – Restoration of bituminous surface shall proceed according to the following steps:

- First, the sub-grade shall be graded to a uniform surface, and 6 inches of Untreated Base Coarse (UBC) gravel shall be placed over the area in lifts not thicker than 3 inches, compacted to 95% of its maximum density.

- Then, the exposed edges of existing pavement shall be primed with a material approved for this purpose.

- Unless shown otherwise on the drawings or required otherwise by the Engineer, hot or cold mix bituminous surfacing shall be spread and compacted in individual, 3-inch maximum lifts over the base course. Minimum thickness of the new bituminous surfacing layer shall be equal to the adjacent surface thickness, but shall be not less than 3 inches thick when compacted to 95% of its maximum density.

- Rolling operations shall be conducted in such a manner that shoving or distortion will not develop beneath the roller. The surface shall be finished to a smooth, uniform line and grade with surface deviations not exceeding plus or minus 1/4 inch in 10 feet, unless the surface is subject to more stringent State, County, or Municipal requirements. The determination of smoothness compliance may be made with a straight edge or string line at the option of the Engineer. Any irregularities shall be satisfactorily corrected at the sole expense of the Contractor.

- Existing driveways, sidewalks, etc., which were removed because they did not match the new finish grade, shall be replaced and restored to their original or better condition to match the new finish grade shown on the Drawings, or as directed by the Engineer.

02500.3.5 REMOVAL AND RESTORATION OF CONCRETE IMPROVEMENTS.

02500.3.5.1 REMOVAL - Existing concrete pavement in streets, alleys, driveways, sidewalks, etc., public or private, shall be cut in accordance with Section 02520, and removed to the lines indicated on the Drawings, or as directed by the Engineer. No ripping or rooting will be permitted outside of the limits of saw cut lines.

Existing driveways, sidewalks, etc., which do not match the new finish grade as shown on the Drawings, also shall be removed preparatory to restoration work.

02500.3.5.2 DISPOSAL - All materials removed shall be disposed of in accordance with Section 1520 of these Specifications, and will not be permitted in the backfill, except as specifically authorized by the Engineer and in accordance with local codes.

02500.3.5.3 RESTORATION - Sub surface preparations shall be the same as those in paragraph 02500.3.4.3 above.

- Concrete pavement including sidewalks, driveways, roadways, and parking area surfacing shall be replaced by the Contractor in accordance with Division 3 of these Specifications, unless otherwise directed by the Engineer

- Those existing driveways, sidewalks, etc., which were removed because they did not match the new finish grade, shall be replaced and restored to their original or better condition to match the new finish grade shown on the Drawings, or as directed by the Engineer.

- All other concrete improvements shall be restored in accordance with details shown on the Drawings, or as directed by the Engineer, and as required by the provisions of Division 3 of these Specifications.

02500.3.6 REMOVAL AND RESTORATION OF FENCES

When necessary to remove any fence to facilitate its operation, the Contractor shall obtain prior agreement with the owner of the fence for its removal. Temporary containment measures shall be provided, if needed, at no additional expense to the Owner. As soon as practical, the permanent fence shall be restored to its original condition or better.

02500.3.7 RESTORATION OF IRRIGATION DITCHES

Restoration of irrigation ditches shall be made in such a manner that the ditch configuration and size will be equivalent to its original condition and the ditch will be located on its original alignment. Any embankment required to restore the original slope of the ditch will be layer compacted with mechanical compaction equipment to 90% of maximum dry density determined by AASHTO T-99.

02500.3.8 CLEANUP

Areas of construction activity shall be left in a condition of uniform grade, blending into pre-existing contours and concealing, as much as possible, evidence of construction activity by back dragging or raking to conceal tire marks. Cleanup and disposal of surplus materials shall be performed in accordance with Section 1520.

02500.4 METHOD OF MEASUREMENT

02500.4.1 NO BID SCHEDULE LINE ITEM

When the Bid Schedule in the Contract does not contain a line item for "Removal and/or Restoration of Surface Improvements", then this work will be considered incidental to other items included in the Bid Schedule, and no separate measurement shall be made for this work.

02500.4.2 “DESIGNATED AREA” LINE ITEM

Measurement for removal and/or of surface improvements in a designated area shall be the "lump sum" of the work required to remove and properly dispose of materials resulting from removal.

02500.4.3 "DESIGNATED FEATURE" LINE ITEM

Measurement for removal and/or restoration of designated features shall be per unit as described in the Bid Schedule.

02500.4.4 BITUMINOUS SURFACE PAY LIMIT

Measurement for bituminous surface removal and replacement shall be made by multiplying the pay limit by the actual length of removal and replacement in lineal feet as determined using a tape measure or other accurate measuring device.

In general, for pipe trench excavation, the pay limit shall be determined by the formula W = OD + 18 inches (pay limit width equals pipe outside diameter plus 18 inches), rounded up to the nearest standard bucket width. Actual measurement may be modified according to information indicated on the Drawings or as directed by the Engineer.

The pay limit for removal of bituminous surface for other purposes shall be as shown on the Drawings or directed by the Engineer.

02500.4.5 DAMAGED ITEMS

Measurement of items damaged or removed as a result of the Contractor's negligence shall not be allowed and no payment will be made under this contract.

02500.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit prices as follows:

PAY ITEM	UNIT
Removal of Site Surface Improvements	Lump Sum
Removal of (*Name of Structures*)	Each
Removal of Sidewalk	Square Yard
Removal of Fences	Lineal Foot
Removal of Driveway Slabs	Square Yard
Removal of Curb and Gutter	Lineal Foot
Removal of Bituminous Surface	Square Yard
Replace (*Name of Structure*)	Each
Replace (*Thickness*) Sidewalks	Square Yard
Replace (*Thickness*) Driveway Slabs	Square Yard
Replace *(Thickness)* Bituminous Surface	Square Yard
Replace (*Description*) Fence	Lineal Foot
Replace (*Description*	Lineal Foot or Lump sum
Restore (*Description*)	Lineal Foot or Lump Sum

ROADWAY MATERIALS SAMPLING AND TESTING — SECTION 02510

02510.1 DESCRIPTION

This section covers all sampling and testing of subgrade and pavement materials. The materials sampling and testing shall be done by an independent certified testing company and all testing reports shall be submitted to the Engineer within a reasonable time period.

02510.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 02200 – Trench Excavation and Backfill
Section 03050 – Portland Cement Concrete

02510.1.2 SUBMITTALS

All sampling and test reports shall be submitted in accordance with Section 01300.

02510.1.3 DEFINITIONS

Not used.

02510.2 MATERIALS

Not used.

02510.3 CONSTRUCTION REQUIREMENTS

02510.3.1 TESTING

The minimum testing requirements are as follows: All Materials sampling and testing shall be done by an independent certified testing company and all testing reports shall be submitted to the Engineer within a (2) two week time period or sooner.

02510.3.1.1 EMBANKMENT

• Maximum Laboratory Density	1 test in each soil type
• Field Density and Moisture	1 test per 2000 square yards

02510.3.1.2 BACKFILL

• Field Density and Moisture	2 tests per culvert or structure (Refer to Section 02200 for Trench Excavation and Backfill Testing)

02510.3.1.3 UNTREATED BASE COURSE

• Sieve Analysis	1 test per production day
• Maximum Laboratory Density	1 test per 10,000 tons
• Field Density and Moisture	1 test per 2000 square yards

02510.3.1.4 ASPHALT CONCRETE PAVEMENT

• Mix design (ASTM 1559 and AASHTO T-283)	1 mix design for the project
• Asphalt temperature	As necessary to assure compliance
• Gradation and Asphalt Content	2 tests per production day
• Field Density	1 test per 1600 square yards

- Mix and Laydown Temperature — As necessary to assure compliance
- Thickness — 1 test per 1600 square yards

02510.3.1.5 PORTLAND CEMENT CONCRETE

- Slump Test — 1 test per load of concrete
- Air Test — 1 test per load of concrete
- Strength Test — 1 compressive strength per 50 cubic yards

02510.4 METHOD OF MEASURMENT

Measurement for this pay item will be by the lump sum.

02510.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price:

PAY ITEM	UNIT
Materials Sampling and Testing	Lump Sum

02511.1 DESCRIPTION

Includes manufacturing, transporting, laying and compacting hot mixtures of bituminous surfacing for roads, parking areas, sidewalks and other traffic surfaces.

02511.1.1 RELATED WORK

Section 02500 – Removal and Replacement of Surface Improvements
Section 02513 - Asphalt Tack Coat

02511.1.2 SUBMITTALS

02511.1.2.1 MIX DESIGN - The Contractor shall develop and submit proposed mix-designs based on the Marshall Method for Hot Asphalt Paving Mixtures as established in AASHTO T 245. The submittal shall include a laboratory report incorporating all of the information required by that specification, together with curves developed from the mix designs showing varying percentages of asphalt by dry weight of mix versus unit weight, percent air voids, stability, flow and percent voids in mineral aggregate.

02511.1.2.2 JOB MIX FORMULA – At least 15 days prior to producing bituminous mixtures, the Contractor shall submit to the Engineer, in writing, a proposed job-mix formula for each mixture for use in setting the job-mix formula to be used with the proposed materials. For bituminous mixtures, the proposed job-mix formula shall be based on a mix-design-run on aggregates, crushed or otherwise, produced for the project and using the bituminous material that will be furnished for the project.

Each job-mix formula shall propose definite single values (hereafter referred to as Target Values or TV) for:

- The percentage of aggregate passing each specified sieve based on the dry weight of aggregate. These percentages shall be within the range shown in Table 2-H.
- The percentage of bituminous material to be added based on the total weight of mixture.
- The temperature of the mixture as it leaves the mixer.
- The temperature of the mixture placed on the road immediately preceding initial compaction of the mixture.
- The kind and percentage of additives to be used (Hydrated lime may be added to prevent stripping).
- The kind and percentage of mineral filler to be used.
- The percentage of water, based on the total dry weight of mixture.
- The maximum specific gravity of dense graded hot mix bituminous paving mixtures as determined by AASHTO T 209 (For open graded hot mixes, the laboratory density developed during mix design shall be used as the TV. It shall be the maximum density for the TV bituminous content).
- The mixture shall have a minimum dry retained strength value of 200 psi.

After reviewing the Contractor's proposed job-mix formula, the Engineer shall determine a job-mix formula with single values for the nine parameters listed above, and so notify the Contractor in writing.

Should a change in source of material be proposed, or should a job-mix formula prove unsatisfactory, the Contractor shall establish a new job-mix formula and shall submit same to the Engineer.

02511.1.2.3 PENETRATION/VISCOSITY/TEMPERATURE RELATIONSHIPS - The Contractor shall submit penetration/viscosity/temperature relationships for the bituminous material to be used in the Work along with a certification from the supplier attesting to their accuracy. If the supplier finds it desirable or necessary to change crudes or blends of crudes, new relationships must be supplied along with a sample to use in running a new mix-design. This submittal shall be made not less than 15 days prior to delivery of material from the changed source of materials. The penetration and viscosity values shall be determined at the temperatures and by the procedures specified in AASHTO M 226.

02511.1.3 DEFINITIONS

Plant - Stationary machinery used for manufacturing mixtures of asphalt cement, liquid asphalt with aggregate to form a uniform mixture of bituminous surfacing. Sometimes referred to as "batch plant".

Aggregate - Crushed stone, gravel or slag with uniform particle sizes.

Gradation - A group of particle size limits that are prescribed for aggregate.

Job-Mix Gradation - A gradation of aggregate which has been developed by a contractor or material supplier which can consistently be produced from a given source.

Job-Mix Formula - A mixture of asphalt materials and aggregate which can be consistently produced from a given source with the available plant of a contractor or material supplier.

Course - A single layer of bituminous surfacing.

Mat - Single or multiple layers of bituminous surfacing which have been placed.

Lot - The amount of bituminous mixture placed during a production day.

02511.2 MATERIALS

02511.2.1 ASPHALT CEMENT

Shall meet the requirements of AASHTO M 20 for penetration-graded asphalt cement and AASHTO M 226 for viscosity-graded asphalt cement. When not shown otherwise, the Contractor shall use viscosity grade AC-20 asphalt cement for the bituminous mixture.

02511.2.2 AGGREGATES

Aggregates for hot bituminous mixtures shall be crushed stone, slag or gravel meeting the quality and gradation requirements shown below in Tables 1-H and 2-H, unless shown otherwise in the Contract Documents.

When crushed gravel is used, at least 50 percent by weight of the particles retained on the Number 4 sieve shall have at least one mechanically fractured face.

TABLE 1-H CRUSHED AGGREGATE QUALITY REQUIREMENTS FOR HOT BITUMINOUS PAVEMENT.

Description	AASHTO Test Method	Requirements
Percent Wear	T 96	40 max.
Durability Index, Coarse and Fine	T 210	35 min.
Sand Equivalent (Alternative Method Number 2)	T176	45 min
Stripping Test	T 182	Min. 95% coated**

** An approved chemical additive may be used to meet this requirement.

TABLE 2-H GRADATION LIMITS FOR CRUSHED AGGREGATE USED IN HOT BITUMINOUS SURFACING.

Sieve Size	Percent of Total Aggregate (dry weight)			
	1-inch (1)	¾-inch (2) (Non-rutting)	¾-inch (3)	½-inch (4)
1 inch	100			
¾ inch		100	100	
½ inch	75-91	74-99		100
3/8 inch		69-91	75-91	
No. 4	47-61	49-65	46-62	60-80
No. 8		33-47		
No. 16	23-33	21-35	22-34	28-42
No. 50	12-22	6-18	11-23	11-23
No. 200	5-9	2-6	5-9	5-9

When aggregate is produced and/or stockpiled in more than one size, the blend of sizes shall be based on results of mix design properties that yield the most ideal results. The blended gradations; however, must stay within the gradation limits given herein.

02511.3 CONSTRUCTION REQUIREMENTS

02511.3.1 BITUMINOUS SURFACE MIXING, PLACEMENT, AND FINISHING

02511.3.1.1 PLANT DESIGN AND EQUIPMENT - Plants shall be specifically designed and manufactured to produce a uniform bituminous mixture. The plant shall be capable of controlling and accurately proportioning both aggregates and asphalt cement. Automatic controls shall be provided to shut down the plant when a supply of aggregate or bituminous material is not available.

The plant shall be equipped with appropriate dust collectors and/or control equipment, which enable operation of the plant to meet local and State environmental and health requirements. Liquids from a wet scrubber, when used, shall not be discharged into live streams, lakes or ponds. Effluent from such equipment shall be collected and deposited according to applicable State and local requirements.

Thermometers shall be installed in the plant to accurately indicate the temperature of the bitumen at the charging value in the mixer unit and at the discharge chute of the mixer unit.

Accurate weight measurement of ingredients is essential. Bituminous mix plants shall have associated weight measurement equipment (scales, etc.) with an incremental accuracy of not more than 10 pounds to weigh materials.

02511.3.1.2 MIXING - The aggregates, bituminous material, additives, mineral filler and water shall be measured or gauged and introduced into the mixer in the amount specified by the job mix formula. The bituminous material shall be evenly heated to the specified temperature. A continuous supply of the bituminous material shall be fed to the mixer at a uniform temperature. The temperatures of asphalt cement delivered to the mixer shall be sufficient to achieve a kinematic viscosity of 150 to 300 centistokes.

Aggregate for pugmill mixing shall be heated, dried, and delivered to the mixing unit at a temperature within $\pm$30°F of the temperature of the bitumen, temperature not to exceed 325 degrees F. Moisture content of the aggregate shall not exceed 1 percent at the time it is introduced into the mixing unit. Flames used for drying and heating shall be properly adjusted to avoid damage to, and soot formation on, the aggregate.

After the required amounts of all materials have been introduced into the mixer, the ingredients shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate have been obtained.

02511.3.1.3 HAULING - Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds that have been thinly coated with a material to prevent the mixture from adhering to the beds. Truck beds shall not contain any water or deleterious material prior to loading.

The Contractor, at no cost to the Owner, shall provide scales for weighing the vehicles used for hauling the bituminous mixture. If of the required accuracy, these scales may be the same as those used to weigh ingredients at the mix plant. The Contractor shall provide such scales at no additional cost to the Owner

02511.3.1.4 PLACEMENT - Except for small areas inaccessible to such equipment, hot bituminous mixtures shall be placed with bituminous pavers. Pavers shall be self-contained, power-propelled units, provided with an adjustable activated-screed or strike-off assembly, heated if necessary, and capable of spreading and finishing courses of bituminous plant mix material in lane widths and thickness' as shown on the Drawings. When shown on the Drawings, pavers shall be equipped with a control system capable of automatically maintaining the proper screed elevation.

Placement of the bituminous mixture shall be continuous. The mixture shall be spread and struck off to the grade and elevation established in the Contract Drawings. Unless otherwise shown on the Drawings, mix shall be placed in lifts which, when compacted, will not exceed 4-inches in thickness.

The longitudinal joint in one layer shall offset that in the layer immediately below by approximately 6-inches, making sure that the joint in the top layer shall be at the center or dividing line of every two-lanes of traveled roadway. Transverse joints in succeeding layers and in adjacent lanes shall be offset at least 10-feet.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable (along forms, curbs, headers, walls and other places), the mixture shall be placed and finished using hand tools and then thoroughly compacted with hot hand tampers, smoothing irons or mechanical tampers.

Bituminous surface shall not be placed when weather conditions prevent proper handling, hauling and placing of the mixture, when the base course is frozen, when the average temperature of the underlying surface is below 35 degrees F, or when the air temperature reaches 50 degrees F and is falling. Placement on water covered surfaces will not be permitted. Subject to the above restrictions, bituminous mixture placement may begin when the air temperature reaches 45 degrees F and is rising.

02511.3.1.5 COMPACTION - Compaction shall be performed with vibratory or non-vibratory steel-wheel rollers and pneumatic-tire rollers. Initial breakdown rolling shall be accomplished while the mix temperature exceeds 250° F. Rolling shall be completed before the mix temperature drops to 175° F.

Rollers shall begin at the sides and proceed longitudinally parallel to the road centerline, each trip overlapping 6-inches or two times the pavement depth, whichever is greater, gradually progressing to the center. When paving in echelons or abutting a previously placed lane, the longitudinal joint should be rolled first, then followed by the above rolling procedure. On super-elevated curves, the rolling shall begin at the low side and progress to the high side.

Rollers shall not pass over the unprotected end of a freshly laid mixture. Transverse joints shall be formed by cutting back into the previous run to expose the full depth of the course. Heat shall be applied to contact surfaces of transverse joints just before additional mix is placed against them.

02511.3.2 EXCESS BITUMINOUS SURFACE MATERIAL.

Material trimmed from the edges, together with any other discarded bituminous mixture, shall be removed from the roadway and disposed of by the Contractor in an approved area.

02511.3.3 TESTING

02511.3.3.1 CONTRACTOR TESTING - The Contractor shall be responsible for providing the necessary tests for controlling and maintaining the mixture within the limits indicated in the approved job-mix formula. Sampling and testing will be performed on each lot of material as it is placed. Gradation and asphalt content samples will be taken immediately behind the paver at the following rate:

LOT TESTING

Lot Size –Sq.Yds.	Minimum Number of Samples
1500 and greater	4
Less than 1500	3

Density and thickness samples will be taken at a rate of one sample per each lot of up to 1500 square yards. When lot size exceeds 1500 square yards, two samples will be taken.

Checks for smoothness will be made at locations selected by the Engineer for each lot. Smoothness checks will not be required where design transitions will not allow compliance with the criteria.

Acceptance of bituminous material placed shall be made by comparing test results with the job-mix formula and the dimensions provided in these Specifications. Acceptance of each lot will be given when test results are within the following tolerances:

BITUMINOUS TEST

Test	Maximum Deviation
Asphalt Content	Mean of tests on each lot is less than 1%
Gradation	Mean of tests for any sieve size is less than 10%
Density	Any test is 92% or greater
Thickness	Any test is less than 0.5-inches
Smoothness	0.25-inches in 10-feet longitudinally or transversely

Any corrective measures necessary to bring the bituminous surface into compliance must be made while the surface temperature is still greater than 175° F.

See Subsection 02511.5.2 – PRICE ADJUSTMENTS, below.

02511.3.3.2 ENGINEER TESTING – At his own discretion, the Engineer also may spot-check the bituminous mix for acceptability and for determination of compliance with installation requirements. These spot-checks will not be used for acceptance but for guidance. On request, the results will be made available to the Contractor by the Engineer.

02511.4 METHOD OF MEASUREMENT

02511.4.1 NO SEPARATE MEASUREMENT

No separate measurement shall be made for furnishing and installing bituminous surface when it is an integral component of a structure or facility shown as another line item in the Bid Schedule.

02511.4.2 SEPARATE MEASUREMENT

When bituminous surface is shown as a separate pay item in the Bid Schedule, measurement shall be made by counting and adding together each square yard of surface in place and accepted. This measurement shall include furnishing all necessary materials and equipment, labor, weighing, mixing, hauling, placement, compaction, and testing to produce an acceptable bituminous surface.

02511.5 BASIS OF PAYMENT

02511.5.1 ACCEPTED QUANTITIES

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
(Depth) Hot Plant Mix Bituminous Surfacing	Square Yards

02511.5.2 PRICE ADJUSTMENTS

02511.5.2.1 DEVIATIONS FROM CRITERIA - For deviations from criteria provided by the approved job-mix formula and in these Specifications and Drawings, the unit price shown in the Bid Schedule will be adjusted by application of the pay factor shown in the tables below:

TABLE A - THICKNESS DEFICIENCY

Pay Factor	Average Core Thickness Deficiency (In Inches)
100	0.00 - 0.25
90	0.26 - 0.50
80	0.51 - 0.75
50	0.76 - 1.00
Remove and Replace	More than 1.00

TABLE B - NON-COMPLYING COMPACTION TESTS

Test Method	Pay Factor	Percent Of Bulk Density Target	
		Mean of all Tests	Lowest of all Tests
ASTM D 3203 (Rice Method)	1.00	95 to 100	90 or greater
	0.90	95 to 100	Less than 90
	0.80	92 to 95	90 or greater
	0.50	Less than 92	90 or greater

TABLE C - NON-COMPLYING BITUMEN CONTENT AND AGGREGATE GRADATION

Criteria	Pay Factor	Mean Deviation Of Number Of Tests In Test Lot									
		1 Test		2 Tests		3 Tests		4 Tests		5 or more Tests	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Bitumen Content	1.00	0.0	0.7	0.0	0.54	0.0	0.46	0.0	0.41	0.0	0.38
	0.975	0.0	0.8	0.55	0.61	0.47	0.52	0.42	0.46	0.39	0.43
	0.95	0.0	0.9	0.62	0.68	0.53	0.58	0.47	0.52	0.44	0.47
	0.90	0.0	1.8	0.69	0.75	0.59	0.64	0.52	0.56	0.48	0.52
	0.85	0.0	1.1	0.76	0.82	0.65	0.69	0.57	0.61	0.53	0.56
½" and larger Sieve	1.00	0.0	10.0	0.0	7.3	0.0	6.3	0.0	5.6	0.0	5.2
	0.975	11.0	12.0	7.4	8.3	6.4	7.1	5.7	6.3	5.3	5.8
	0.95	13.0		8.4	9.3	7.2	7.9	6.4	7.0	5.9	6.4
	0.90	14.0		9.4	10.3	8.0	8.7	7.1	7.7	6.5	7.1
	0.85	15.0		10.4	11.3	8.8	9.5	7.8	8.4	7.2	7.7
3/8" Sieve	1.00	0.0	9.0	0.0	6.9	0.0	5.9	0.0	5.3	0.0	4.9
	0.975	10.0		7.0	7.8	6.0	6.6	5.4	5.9	5.0	5.5
	0.95	11.0		7.9	8.7	6.7	7.3	6.0	6.6	5.6	6.1
	0.90	12.0	13.0	8.8	9.6	7.4	8.0	6.7	7.2	6.2	6.6
	0.85	14.0		9.7	10.5	8.1	8.9	7.3	7.9	6.7	7.2
No. 4 Sieve	1.00	0.0	9.0	0.0	6.7	0.0	5.7	0.0	5.2	0.0	4.8
	0.975	10.0		6.8	7.6	5.8	6.3	5.3	5.8	4.9	5.4
	0.95	11.0		7.7	8.5	6.4	6.9	5.9	6.4	5.5	5.9
	0.90	12.0	13.0	8.6	9.4	7.0	7.5	6.5	7.0	6.0	6.5
	0.85	14.0		9.5	10.2	7.6	8.0	7.1	7.6	6.6	7.0
No. 8 Sieve	1.00	0.0	7.0	0.0	5.6	0.0	4.8	0.0	4.3	0.0	4.0
	0.975	8.0		5.7	6.3	4.9	5.4	4.4	4.8	4.1	4.5
	0.95	9.0		6.4	7.0	5.5	6.0	4.9	5.3	4.6	4.9
	0.90	10.0		7.1	7.7	6.1	6.6	5.4	5.8	5.0	5.4

Criteria	Pay Factor	Mean Deviation Of Number Of Tests In Test Lot									
		1 Test		2 Tests		3 Tests		4 Tests		5 or more Tests	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	0.85	11.0	12.0	7.8	8.5	6.7	7.2	5.9	6.4	5.5	5.8
No. 16 Sieve	1.00	0.0	7.0	0.0	5.2	0.0	4.6	0.0	4.2	0.0	3.9
	0.975	8.0		5.3	5.8	4.7	5.1	4.3	4.6	4.0	4.3
	0.95	9.0		5.9	6.4	5.2	5.6	4.7	5.1	4.4	4.7
	0.90	10.0		6.5	7.0	5.7	6.1	5.2	5.5	4.8	5.1
	0.85	11.0	12.0	7.1	7.6	6.2	6.6	5.6	5.9	5.2	5.4
No. 50 Sieve	1.00	0.0	6.0	0.0	4.3	0.0	3.8	0.0	3.4	0.0	3.2
	0.975	7.0		4.4	4.8	3.9	4.1	3.5	3.8	3.3	3.5
	0.95	8.0		4.9	5.3	4.2	4.5	3.9	4.1	3.6	3.8
	0.90	9.0		5.4	5.8	4.6	4.9	4.2	4.4	3.9	4.1
	0.85	10.0		5.9	6.4	5.0	5.5	4.5	4.9	4.2	4.5

02511.5.2.2 REMOVAL OF MIX - The Engineer may order the removal of the mix if the mean result of the lot acceptance tests deviate from the job-mix formula for a particular sieve or sieves, or if the asphalt content is more than the values shown under the 0.85 pay factor in Table C. Where material not meeting this criteria is allowed to remain, a pay factor of 0.50 will be applied.

When the tested density percentage pay factor in Table B is multiplied by the pay factor shown in Table C, and the product is less than 0.80, the Engineer may order removal of the mix. Where material not meeting this criteria is allowed to remain, a pay factor of 0.50 will be applied.

02511.5.2.3 ADDITIONAL MIX - When a lot shows a deficient thickness of more than 0.5-inches, the Engineer may order additional material to be placed and additional payment for the material required will be allowed. When excess thickness is determined, the Engineer may allow it to remain in place; however, only 50 percent of the mix in excess of the 0.5-inch tolerance will be paid for.

02511.5.2.4 OPTIMAL ASPHALT CONTENT PERCENTAGE - Optimal asphalt content percentage will be determined from the job-mix formula provided by the Contractor unless the bituminous mixture is obtained from an established commercial asphalt plant. In such case, the optimum percentage may be determined from previous mixes which meet the criteria provided in these Specifications.

02513.1 DESCRIPTION

This section covers preparing an existing bituminous or concrete surface and then furnishing and applying an asphalt coating to it.

02513.1.1 RELATED WORK

Section 02511 - Hot Plant Mix Bituminous Pavement
Section 02512 - Road Mix Bituminous Pavement

02513.1.2 SUBMITTALS

The Contractor shall provided certificates from the paving asphalt vendor indicating the type and grade of material being provided and its compliance with the standards indicated herein.

02513.1.3 DEFINITIONS

Not used.

02513.2 MATERIALS

The asphalt coating shall meet the current requirements contained in the "Standard Specifications for Paving and Industrial Asphalts" issued by the Asphalt Institute, for the type and grade of asphalt shown on the Drawings or in these Specifications. When the asphalt type and grade are not shown on the Drawings or in these Specifications, SS-1 or SS-1h emulsified asphalt diluted with not more than one part water to one part emulsified asphalt will be acceptable.

02513.3 CONSTRUCTION

02513.3.1 WEATHER LIMITATIONS

Tack coats shall be applied only when air and roadbed temperatures in the shade are greater than 50° F. Application of tack coats shall not be made during rain, fog, dust, or other unsuitable weather.

02513.3.2 PREPARATION

Prior to application of the tack coat, the receiving surface shall be broomed to remove dust and loose foreign materials. The Contractor shall provide notice of application to adjacent property owners 24 hours prior to applying the coating. Appropriate measures shall be taken to provide crossings for foot or vehicular traffic to minimize tracking of freshly applied tack coating.

If flushing of the surface with water is necessary for removal of dust and foreign material, the Engineer may require flushing. When flushing is ordered, the Contractor will be authorized compensation for flushing by issuance of a Change Order.

02513.3.3 APPLICATION

Limit application of tack coats to areas which can be covered with an asphalt pavement layer that same day when possible.

Application of the coating shall be accomplished with a distributor designed, equipped, maintained and operated so that bituminous material will be applied at an even temperature and uniform rate on variable widths of surface up to 16-feet. The distributor must be capable of controlling rates of

application from 0.05 to 2.0 gallons per square yard, with uniform pressure and with a variation from the rate set not to exceed 0.02 gallon per square yard. Operable measuring equipment shall be included on the distributor which includes a tachometer, pressure gauges, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperature of the bituminous in the tank. Distributors shall be equipped with (1) a power unit for the pump; (2) full circulation spray bars that adjust laterally and vertically; and (3) a hose and nozzle attachment for applying material to areas inaccessible to the distributor spray bar.

Spray rates for the coating shall be as required by the Drawings or these Specifications. When no rate is specified otherwise, the Engineer may require an application rate for emulsions of 0.05 to 0.15 gallons per square yard.

02513.3.4 PROTECTION

Protect adjacent structures,(curbing, sidewalks, guardrails, sign posts, etc.) from being spattered or marred by covering with suitable materials. The expense of removal of such spattering shall be born by the Contractor.

Traffic shall not be allowed to travel over the freshly applied coating until it has cured sufficiently to not be picked up by traffic.

02513.4 METHOD OF MEASUREMENT

Measurement of Asphalt Tack Coat shall be by the ton or gallon for the type and grade of material furnished and applied.

02513.5 BASIS OF PAYMENT

The accepted quantity will be paid for at the contract unit cost for:

PAY ITEM	UNIT
Asphalt Tack Coat (*Type/Grade*)	Ton
Asphalt Tack Coat (*Type/Grade*)	Gallon

PAVEMENT SAW CUTTING — SECTION 02520

02520.1 DESCRIPTION

This section covers cutting through designated sections of bituminous and/or concrete pavement surface with approved equipment in preparation for pavement removal.

02520.1.1 RELATED WORK

Section 02200 - Trench Excavation and Backfill
Section 02208 - Flowable Backfill (required during winter months)
Section 02500 - Removal and Replacement of Surface Improvements

02520.1.2 SUBMITTALS

Not used.

02520.1.3 DEFINITIONS

Not used.

02520.2 MATERIALS

Not used

02520.3 CONSTRUCTION REQUIREMENTS

02520.3.1 SAW CUTTING

02520.3.1.1 NEATNESS IN CUTTING - Pavement cuts shall be made with a saw to produce straight vertical cuts through the full depth of the surfacing layer. The Contractor is responsible to preserve and maintain a neat clean edge on the cut pavement to facilitate pavement repair or replacement under Section 02500.

02520.3.1.2 CUT MATERIALS TO BE LEFT IN PLACE - Cut pavement materials shall be left in place. Removal of cut pavement will be included as part of other work items in this Contract.

02520.3.1.3 BROKEN PAVEMENT - When pavement has deteriorated or is severely cracked and broken, the Contractor shall discontinue cutting operations and obtain direction from the Engineer as to how cutting should proceed.

If pavement is broken after sawcutting and prior to replacement, the Contractor shall re-cut the pavement. Such re-cutting shall not be measured for payment.

02520.3.2 WHEEL CUTTING

With advanced written approval of the Engineer, wheel cutting may be substituted for saw cutting of bituminous pavement surface. Wheel cutting operations shall be subject to the same requirements as those for saw cutting pavement above.

02520.3.3 ROTOMILLING

Rotomilling of existing pavement is an acceptable alternative to saw cutting, providing that the resulting pavement edges are left clean and neat. Rotomilled material may be suitable for trench backfilling or as a substitute for road base. For such use, rotomilled material must meet the following conditions: that: no chunks or pieces larger than one inch in any dimension are used, that

it is placed in separate lifts from untreated base course, that it is compacted to 95% of its maximum density, and that it is acceptable to the Engineer and to the Owner.

02520.4 METHOD OF MEASUREMENT

Measurement for pavement cutting shall be made using a tape measure or other accurate measuring device to determine the number of lineal feet of pavement cut. This length shall be multiplied by the actual depth of the cut pavement layer, measured in inches, to give the number of inch feet of cut.

An alternative method of measurement is for the Engineer to determine that all pavement cutting shall be paid for by the measured lineal feet without regard to depth.

02520.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
Pavement Sawing	Inch/Foot
Pavement Sawing	Lineal Feet

02810.1 DESCRIPTION

This section covers furnishing and installing chain link fence and gates as indicated on the Drawings

02810.1.1 RELATED WORK

Section 03050 - Portland Cement Concrete

02810.1.2 SUBMITTALS

Not used.

02810.1.3 DEFINITIONS

Not used.

02810.2 MATERIALS

02810.2.1 FENCING FABRIC, SUPPORT, AND CONNECTORS

02810.2.1.1 FABRIC - Fence fabric shall be in accordance with ASTM A-392 and have the following characteristics:

FENCE FABRIC CHARACTERISTICS

Height	6'-0"
Mesh	2 inch, coated
Size Wire	11 gauge
Coating	Zinc (galvanized)

02810.2.1.2 TOP RAIL - Top rail shall be 1 5/8 inch OD, galvanized steel pipe @ 1.82 lbs./ft., or fence tube of equivalent structure, size and strength.

02810.2.1.3 WIRE RING TIES - Use wire ring ties that carry a Class II coating and are 11-gauge wire in accordance with ASTM A-116.

02810.2.1.4 BARBED WIRE - Barbed wire for extension arms shall have the following characteristics:

BARBED WIRE CHARACTERISTICS

Total Number Strands	3 strands barb wire
Wires per Strand	2
Wire Size	12 gauge (minimum)
Barbs	14 gauge, 4 point @ 4" o.c.
Coating	Zinc (galvanized)

02810.2.1.5 TENSION WIRE - Tension wire shall be 7 gauge galvanized coil spring steel wire in accordance with ASTM A-641.

02810.2.1.6 TRUSS RODS - Truss rods shall be 3/8 inch galvanized steel rod.

02810.2.1.7 EXTENSION ARMS - Extension arms for gate and other fence posts shall be fabricated from galvanized steel. They shall be designed and manufactured to carry three separate strands of barbed wire and shall be capable of supporting a 200-pound vertical load at the end of the arm without causing permanent deflection. Gateposts shall be provided with vertical extension arms while all other post shall have 45° angle extension arms. The top rail shall pass through the extension arm fitting.

02810.2.2 POSTS

All pipe posts shall be provided with tops that shed water. All posts, rails, and appurtenances shall be provided in accordance with ASTM A-120, A-121, A-123 or A-153, respectively.

02810.2.2.1 LINE POSTS - Line posts shall be "H" section at 4.10 pounds per lineal foot, or 2-3/8 inch OD galvanized pipe at 3.12 pounds per lineal foot, or fence tube of equivalent size and strength.

02810.2.2.2 END, CORNER, AND PULL POSTS - End, corner and pull posts shall be 2-7/8 inch OD pipe at 4.64 pounds per lineal foot, galvanized pipe or fence tube of equivalent size and strength.

02810.2.2.3 GATEPOSTS - Except where shown otherwise in the Contract Documents, gateposts shall be provided in accordance with the table below. Gateposts shall be Schedule 40 galvanized steel pipe of the diameter and weight shown. Fence tube of equivalent size and strength may be substituted for the galvanized steel pipe specified herein.

GATEPOST SPECIFICATIONS

Leaf Width	**Gate Post OD**	**Lbs per Lineal Ft**	**Concrete Foundation**	
			Diameter	Depth
0’ – 6’	2-7/8”	5.7	12”	3’-0”
Over 6’ to 13’	4”	9.0	18”	4’-0”
Over 13’ to 18’	6-5/8”	18.9	18”	4’-0”
Over 18’	8-5/8”	28.5	18”	4’-6”

02810.2.3 GATES

02810.2.3.1 TYPE AND SIZE - Swing gates of the type and size shown on the Drawings shall be used for all chain link fence gates.

02810.2.3.2 FRAME - Gate frame piping shall be 1 7/8 inch OD galvanized pipe weighing 2.68 pounds per lineal foot. Corner fittings shall be heavy pressed steel or malleable castings.

02810.2.3.3 CATCH AND LOCK - Gates shall be provided with an appropriate steel or malleable iron catch and locking attachment. Double swing gates shall be provided with a center rest and catch mechanism. Stops shall be provided to hold gates open.

02810.2.3.4 FABRIC - Chain link fence fabric used to cover gate frames shall conform to the same standards as the line fence fabric.

02810.2.4 CONCRETE

Concrete for setting posts and other fencing components for chain link fence and gates shall be Class 2000 or higher with 3/4 inch maximum aggregate in accordance with Section 03050 of these Specifications.

02810.3 CONSTRUCTION REQUIREMENTS

02810.3.1 GENERAL

Finished fence shall be plumb, taut, true to line and grade, and complete in all details. Fence shall be installed with a top rail and a bottom tension wire. Top rail shall provide allowance for expansion and contraction due to temperature differential in the coupling devices. The ground shall be graded before fence posts are located to permit the grade of the fence to remain uniform over any local elevations or depressions in the ground line. Any resultant surplus soil or concrete, etc., shall be removed and the line shall be cleaned up prior to completion of the Work.

02810.3.2 POSTS

02810.3.2.1 BRACING - End, corner, pull, slope and gateposts shall be braced to the midpoint of the nearest line post or posts with horizontal braces used as compression members. The bracing material shall be the same as top rail material. The brace posts shall be trussed from the brace back to the bottom of the end, corner, slope or gatepost with steel truss rods with turnbuckles, or other suitable tightening devices used as tension members.

2810.3.2.2 LINE POST PLACEMENT - Line posts shall be placed in accordance with the following spacing requirements:

LINE POST PLACEMENT

Radius of Curve	Maximum Post Spacing
Tangent Section to 500 ft	10 ft.
200 ft. to 499 ft.	8 ft.
100 ft. to 199 ft.	6 ft.
0 ft. to 99 ft	5 ft.

02810.3.2.3 PULL POST PLACEMENT - Pull posts shall be located at 500-foot maximum intervals and/or at all angle points exceeding 20°.

02810.3.3 CONCRETE

02810.3.3.1 DEPTH OF SET - Post sockets in concrete walls shall be set to a minimum depth of 18 inches. Line posts shall be set in concrete to a minimum depth of 18 inches. End, pull, corner and gateposts less than 6 inches in diameter shall be set in concrete to a minimum depth of 24 inches. Gateposts 6 inches diameter and greater shall be set in concrete to a depth of 30 inches

A minimum of 6 inches concrete shall be placed in each posthole below each post depth of set described in the foregoing paragraph.

02810.3.3.2 FINISH - Concrete for fence posts shall be finished with a minimum of 1 inch of concrete left above finish grade and sloped in all directions to allow water to drain away from the post.

02810.3.4 FENCE FABRIC

02810.3.4.1 PLACEMENT - Fence fabric shall be installed on the outward facing side of the posts and parallel to the line of the fabric. It shall be 1 inch above the ground on straight grade with the top edge projecting over the top rail of the fence. Space between the bottom of the fence and the finished ground line shall not exceed 3 inches.

02810.3.4.2 FASTENING - Fence fabric shall be stretched taut and securely fastened to the posts, the top rail and the bottom tension wire. Install the tension wire.

Fabric shall be attached to line posts every 14 inches with 11 gauge hot dip galvanized wire clips or galvanized steel bands. It shall be attached to terminal, corner, and gateposts every 14 inches by using 1/4" x 3/4" tension bars tied to the posts with 1 inch wide, hot-dip galvanized steel bands and 3/8 inch diameter bolts and nuts. Attach to both the top rail and the tension wire with 11 gauge wire ring ties spaced every 24 inches.

02810.3.5 CHAIN LINK GATE

02810.3.5.1 INSTALLATION - Chain link gates of size and type shown on the Drawings shall be installed plumb, level and secure for full opening without interference. The gates shall be installed at the locations shown, unless approved otherwise by the Engineer. Ground items shall be set in concrete for anchorage as recommended by fence manufacturer.

The corners of gate frames shall be fastened together and reinforced with fittings designed for the purpose or by welding. All welds shall be ground smooth.

02810.3.5.2 FABRIC - Chain link fence fabric shall be attached to gate frames with tension bars and tie wire attached to suitable tension connectors spaced at approximately 15 inches at each end, and to the top and bottom rails with tie wires spaced at approximately 24 inches.

02810.4 METHOD OF MEASUREMENT

Measurement for chain link fence shall be made using a tape measure or other accurate measuring device to determine the number of lineal feet of fence installed and accepted. This measurement shall include all work and materials, excavation, concrete and concrete placement, gates and bends, etc., all to be furnished and installed as shown on the Drawings and described herein.

02810.5 BASIS OF PAYMENT

PAY ITEM	UNIT
Chain Link Fence	Lineal Foot

02830.1 DESCRIPTION

This section covers furnishing and installing stock fencing and gates as indicated herein and as shown on the Drawings.

Use stock fence and gates as right-of-way fence and gates.

02830.1.1 RELATED WORK

Section 03300 – Concrete Structures and Slabwork

02830.1.2 SUBMITTALS

Not used.

02830.1.3 DEFINITIONS

Not used.

02830.2 MATERIALS

02830.2.1 FENCE MATERIALS

02830.2.1.1 BARBED WIRE - Barbed wire for fencing shall meet the following standards:

BARBED WIRE REQUIREMENTS

Total Number Strands	As called for on Drawings
Wires per Strand	2
Wire Size	12 gauge (minimum)
Barbs	14 gauge, 4 point @ 4" o.c.
Coating	Zinc (galvanized)

02830.2.1.2 WIRE MESH FABRIC - Wire mesh fabric for fencing shall meet the following standards.

WIRE MESH FABRIC REQUIREMENTS

Wire Grade	Firm
Wire Size	Nominal 0.099
Vertical Spacing	6 inches
Coating	Class 1 Zinc
Fabric Specification	ASTM A-116

02830.2.2 POSTS

02830.2.2.1 STEEL LINE POSTS - Steel line posts shall have either a Y or U cross-section, shall be painted, and shall have been manufactured for use in stock fencing.

02830.2.2.2 WOOD LINE POSTS - All posts must be sound and free of decay, being structurally fit to function properly. Wood line posts shall meet the following requirements:

- Round posts shall have a minimum circumference of 10 inches at the base. All natural-growth round posts shall be free of bark, protruding knots, and any other irregularities.

- Rectangular posts shall have a minimum cross section area of 12 square inches.
- Untreated posts shall be of un-sawn native juniper, or approved equal.
- Treated line posts shall be of Douglas Fir, hemlock or pine. If the treated surface of a post has been disturbed or damaged in handling or installation, the exposed, untreated wood shall receive a minimum of two coats of the same compound with which the post was originally treated.

02830.2.2.3 BRACE, GATE, AND CORNER POSTS – Brace, gate, and corner posts shall conform to ASTM A-702. Steel brace, gate, and corner posts shall have the following characteristics:

02830.2.2.4 GALVANIZED PARTS - Galvanized parts shall be in accordance with ASTM A-123.

02830.2.2.5 ANCHORS - Supply fence stop anchors. Anchor plates on steel posts may be omitted when the post is set in a concrete footing but not otherwise.

02830.2.3 STEEL GATES

02830.2.3.2 FRAME – Frames for driveway and walkway gates shall be of 1-inch diameter pipe as specified in ASTM A-120, Schedule 40. Frames shall have caps or seals to cover the open ends of square corners of gate frames.

02830.2.3.3 WIRE FABRIC – See 02830.2.1.2 above.

02830.2.3.4 BRACING – 10 and 12 foot long gate leafs shall have at least one vertical brace made of the same material as the frame and placed in the center of the leaf. 14 and 14 foot long gate leafs shall have two vertical braces of the same material and spaced evenly in the leaf.

02830.2.3.5 TRUSSING – Gates 10 feet or more in length shall have an adjustable 3/8-inch minimum diameter truss rod installed to prevent sagging of the gate.

02830.2.3.6 FITTINGS - Fittings for gates shall be hot-dipped galvanized steel as specified in accordance with ASTM A-153. Pintles shall be 5/8-inch in diameter or greater for 10-foot and wider gates.

02830.2.3.7 FASTENERS – Fasteners for single gates shall be lengths of galvanized chain a minimum of 18-inches long. One end of the chain shall be secured to the gate while the loose end shall be fitted with a snap fastener appropriate to the size of the chain. For additional security, chain link slot fasteners also may be incorporated into the gate.

Double leaf driveway gates shall have a center latch incorporating a pin or rod which can be dropped from the latch into a socket embedded in concrete in the ground.

02830.2.3.8 STAPLES – Staples shall be 1-1/2-inch minimum length No. 9 wire.

02830.2.3.9 CONCRETE – Concrete shall be Class B (AE) or better.

02830.3 CONSTRUCTION REQUIREMENTS

02830.3.1 GENERAL

Finished fence shall be plumb, taut, securely fastened, true to line and grade, and complete in all details.

02830.3.2 POST INSTALLATION

02830.3.2.1 GATEPOSTS - Except where shown differently on the plans, gatepost installation and concrete foundations for gateposts shall be as determined by the following schedule:

GATEPOST SPECIFICATIONS

Leaf Width	Gate Post OD	Lbs per Ln. Ft.	Concrete Foundation	
			Diameter	Depth
0’ – 6’	2-7/8”	5.7	12”	3’-0”
Over 6’ to 13’	4”	9.0	18”	4’-0”
Over 13’ to 18’	6-5/8”	18.9	18”	4’-0”
Over 18’	8-5/8”	28.5	18”	4’-6”

02830.3.2.2 STEEL LINE POSTS - Construction of 4-strand barbed wire fencing shall require 6-foot posts; 5-strand barbed wire fencing shall use 7-foot posts.

02830.3.2.3 WOOD POSTS - Cut wood posts to the designated height and slant top to an approximate 30^0 angle.

02830.3.2.4 POST BRACING - Install end-braced posts in existing cross fences where they are intersected by the new stock fence. Brace corner posts in two directions. Brace end and gate posts in one direction. Bolt or butt weld metal braces to the metal posts. Tension brace wires until installation is rigid.

02830.3.2.5 TRUSSING - Braced posts shall be trussed back to the bottom of the end, corner, slope or gatepost.

02830.3.2.6 CONCRETE - At sag sections, or at points of vertical alignment change in concrete foundations, set braced posts at least 2-feet 9-inches into the ground for 7-foot, 0-inch posts and at least 2-feet 6-inches into the ground for 6-foot, 0-inch posts. Place a minimum 3-inch concrete base below each brace post. Concrete shall be a minimum 18-inches in diameter. Expose 1-inch on concrete above the finished grade, finish off and slope to drain away from the post. Backfill and compact posts.

Set fence stop anchors in concrete foundations at least 18-inches into the ground. Concrete shall be a minimum of 18-inches in diameter. Finish exposed concrete flush with existing grade.

02830.3.3 FENCE WORK

02830.3.3.1 BARBED WIRE - Barbed wire fencing shall be constructed of either 4-strands or 5-strands of wire as shown on the Drawings and/or described in the Special Provisions attached hereto. See also Sub-Section 02830.3.2.2 – Steel Line Posts, above. Install barbed wire on the inside of the post, away from the traffic.

02830.3.3.2 FABRIC - Wire mesh fabric shall be of the width shown on the Drawings and/or described in the Special Provisions attached hereto. Install fence fabric and barbed wire on the inside of the post, away from the roadway.

Remove all sags from wire mesh fabric without causing tension crimps to fail. Staple top and bottom wires and every alternate lateral wire in the mesh fabric and each strand of barbed wire to the post.

02830.3.4 STEEL GATES

02830.3.4.1 GATES - Supply steel gate frames with wire fabric and appropriate appurtenances for all gates shown on the Drawings.

02830.3.4.2 INSTALLATION - Provide steel gates with fittings to fill all clear openings between gateposts as shown on the Drawings. Install gates to open clearly without interference and to function properly.

02830.4 METHOD OF MEASUREMENT

Measurement for stock fence and gates shall be made using a tape measure or other accurate measuring device to determine the total number of lineal feet of fence installed and accepted. This measurement shall include all material, equipment, labor, excavation and backfill, gates, bends, concrete and concrete placement including gates and bends, all to be furnished and installed as shown on the Drawings and described herein.

02830.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
Stock Fence	Lineal Foot

02890.1 DESCRIPTION

This work shall consist of installing only, or furnishing and installing delineators, signs, sign supports, panels and posts or removing and disposing of existing signs, posts and hardware.

02890.1.1 RELATED WORK

Section 02005 – Traffic Control

02890.1.2 SUBMITTALS

Not used.

02890.1.3 DEFINITIONS

Not used.

02890.2 MATERIALS

02890.2.1 TRAFFIC CONTROL SIGNS

Traffic control sign details not shown on the Drawings shall meet the requirements of the Manual of Uniform Traffic Control Devices issued by the U.S. Department of Transportation. Requirements for temporary signs used for traffic control during construction are provided in Section 02005 of these Specifications.

02890.2.1.1 SIGN PANELS

02890.2.1.2 PANELS – All panels shall be of one-piece construction made from plywood, sheet steel or sheet aluminum, as shown in the Schedule of Items. All panels shall have the face side reflectorized.

02890.2.1.3 PLYWOOD PANELS – Plywood panels shall be exterior Type B-B, high-density overlay, 60/60 with black overlay on both sides, 3/4-inch 7 ply or ½-inch 5 ply thick, Douglas fir plywood or better, meeting the requirements of the National Bureau of Standards PS-1, current edition or as shown on the Drawings. Other overlay colors may be used provided the back of the panel is printed with two heavy coats of black paint.

Paint used shall be ready-mixed, exterior type, polysilicone alkyd resin base enamel, Benjamin Moore No. 120-60 (Federal Color Chip No. 20059), or approved equal.

02890.2.1.4 ALUMINUM PANELS - All aluminum sheet or plate used for panels shall meet the requirements of ASTM B-209, alloy 6061-T6 or 5052-H38 and shall be of the thickness prescribed below, unless otherwise shown on the Drawings.

SHEET ALUMINUM REQUIREMENTS

Sign Width (Inches)	Sheet Aluminum Thickness (Inches)
Less than 8	0.022
8-12	0.040
13-19	0.063
20-30	0.080
31-48	0.100
over 48	0.125

02890.2.1.5 STEEL PANELS - The finished plate for steel panels shall be free of twist or buckle, and the background shall be substantially a plane surface. The finished sign panel shall be of continuous coat mill-galvanized phosphate coated steel.

02890.2.2 SIGN POSTS

02890.2.2.1 POSTS - Posts shall be wood, aluminum, steel or other material as specified.

02890.2.2.2 WOOD POSTS - Wood posts shall be construction grade or better Douglas Fir or graded pine, and shall conform to the grading and dressing rules of the Western Wood Products Association. Wood posts shall cut to size before treatment and shall be of the dimensions shown on the Drawings. Unless otherwise specified, posts shall be incised before treatment as a means of improving penetration of the preservative. Wood posts shall be pressure treated in accordance with AASHTO M-133 and/or the Uniform Building Code for Posts and also in compliance with the standards of the American Wood Preservers Association.

02890.2.2.3 STEEL POSTS. Steel posts shall meet the requirements of ASTM A-299, galvanized in accordance with AASHTO M-111. Minimum weight per foot will be as shown on the Drawings.

The posts shall have 7/16-inch holes drilled or punched, before galvanizing, along the centerline of the web. The punching or drilling should begin 1-inch from the top of the post, at 2-inch centers for the upper 5-feet of the post.

02890.2.2.4 ALUMINUM POSTS - Aluminum posts shall be standard shapes as shown on the Drawings and shall be aluminum alloy 6061-T6 or 6351-T5, meeting the requirements of ASTM B-221.

02890.2.3 FITTINGS

Lag screws, washers, clip angles, wood screws, shear plates, U-bolts, clamps, bolts, nuts and other fasteners shall be galvanized steel, cadmium-plated steel, aluminum alloy or as shown on the Drawings. Galvanizing of steel hardware shall be in accordance with AASHTO M-232. High-strength steel bolts, nuts and washers shall meet the requirements of ASTM A-325, except as shown in the Drawings.

02890.2.4 REFLECTIVE MATERIALS TYPE II AND TYPE III REFLECTIVE SHEETING

All reflective materials (sheeting, legend, borders and symbols) shall conform to the "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects," FP, current edition and Federal Specification L-S-300C. Colors shall be as specified in the MUTCD and enclosed drawings. No more than 12 months shall elapse from the date of manufacture to the date of application on the substrate.

02890.2.5 CHARACTERS, SYMBOLS, AND COLORS

02890.2.5.1 CHARACTERS, SYMBOLS, AND BORDERS - Letters, numerals, arrows, symbols, border and other features of the sign message shall be of the type, size and series shown on the Drawings.

02890.2.5.2 COLORS - Colors shall be as specified in MUTCD or shown on the Drawings. Completed letters, numerals and other units shall be formed to provide continuous stroke width with smooth edges and shall present a flat surface free of warp, blisters, wrinkles, burrs and splinters. Units of the sign message of the type shown on the Drawings shall meet the following requirements:

02890.2.5.3 SCREEN PROCESS APPLICATION (type L-1 Screen Process) - The letters, numerals, arrows, symbols and border shall be applied on the reflective sheeting or opaque background of the sign by

direct or reverse screen process. Messages and borders of a color darker than the background shall be applied to the paint or the reflective sheeting by direct process. Message and borders of a color darker than sign field shall be produced by the reverse screen process.

- Opaque or transparent colors, inks and paints used in the screen process shall be of the type and quality recommended by the manufacturer of the reflective sheeting.
- The screening shall be done in a manner that results in a uniform color and tone, with sharply defined edges of legend and border and without blemishes on the sign background that will affect intended use.
- After screening, signs shall be air dried or baked in accordance with manufacturer's recommendations to provide a smooth, hard finish. Any signs on which blisters appear during the drying process shall be rejected.

02890.2.5.4 DIRECT APPLICATION (type L-3 Direct Applied Characters) - The letters, numerals, symbols, border and other features of the sign message shall be cut from Types II or III reflective sheeting of the color specified in MUTCD or shown in the Drawings and applied to the reflective sheeting of the sign field in accordance with the instructions of the manufacturer of reflective sheeting.

The reflective sheeting shall have minimum reflective intensity (candelas per Foot-candle) as shown below:

MINIMUM REFLECTIVE INTENSITY

Entrance Angle	White	Yellow	Red
0^o	115	70	30
20^o	20	25	12

02890.2.6 DELINEATORS

The materials to be used for the delineator assembly shall be as shown on the Drawings. The reflectors shall be amber or crystal and ready for mounting. Supporting posts shall be steel, aluminum, wood or other material as shown on the Drawings.

02890.3 CONSTRUCTION REQUIREMENTS

02890.3.1 FABRICATION OF SIGN PANELS

All panel fabrication, including cutting, punching and drilling of holes, shall be completed prior to final surface preparation and application of reflective sheeting, except where required for the fabrication of die-cut or sawed letters on processed and mounted signs. Metal panels shall be cut to size and shape and shall be free of buckles, warp, dents, cockles, burrs and defects resulting from fabrication. The surface of all sign panels shall be flat.

Field drilling of holes in any part of the structural assembly will not be permitted without the approval of the Engineer.

02890.3.2 PANELS

02890.3.2.1 ALUMINUM PANELS - Aluminum sign panels shall be fabricated from standard widths of aluminum sheet. The blanks shall be cleaned, degreased and chromated or otherwise properly prepared in accordance with approved methods recommended by the sheeting manufacturer.

02890.3.2.2 STEEL PANELS - The panels shall be cleaned, degreased or otherwise prepared in accordance with approved methods recommended by the sheeting manufacturer.

02890.3.2.3 PLYWOOD PANELS - The face of the plywood panel shall be abraded, cleaned and degreased in accordance with approved methods recommended by the manufacturer of the reflective sheeting. The edges of the plywood panel shall be sealed with 2 mil dry film thickness (in 2 coats); one coat shall be applied before application of reflective sheeting, the other, after.

02890.3.2.4 DURABILITY TREATMENT - After all reflective sheeting legend has been applied, sign panels with Type II sheeting shall be recycled in the heat and vacuum applicator for 2 minutes at a temperature of approximately 190°F under 21-inches of vacuum. When the sign panel has cooled, the top edge of each sign shall be covered with a clear 3-inch wide polyester film with a sun-resistant, pressure-sensitive adhesive that does not turn yellow under exposure to ultraviolet radiation. Scotchcal Brand Film #639 or Engineer approved equal shall be used. Film shall be applied in lengths of 24-inches. Where more than one piece is required, film shall be applied from each corner of the top edge toward the center of the top edge. End overlap of 2-inches or more shall be required where one film piece joins another piece.

02890.3.3 DELINEATOR POSTS AND HOUSING

Delineator posts shall be driven at locations and to the depth shown on the Drawings. The delineator housing shall be attached to the post in accordance with the manufacturer's direction.

02890.3.4 SIGN ERECTION

02890.3.4.1 SUPPORTS - Sign supports shall be erected plumb and in accordance with the details shown on the Drawings and in a manner consistent with the U.S Department of Transportation's "Manual of Uniform Traffic Control Devices" to reduce glare.

02890.3.4.2 FASTENING PANELS - The sign panels shall be securely fastened to the posts as shown on the Drawings.

02890.3.5 SIGN REMOVAL

Sign assemblies to be removed shall be shown on the Drawings. Where signs are to be replaced, signs shall be removed just before the installation of replacement signs. All sign materials removed shall become the property of the Contractor. Posts shall be removed to a minimum of 3-inches below natural ground line. Post holes remaining shall be backfilled with suitable material and compacted.

02890.4 METHOD OF MEASUREMENT

02890.4.1 Measurement for signs shall be made by (1) counting the number of signs in place and accepted or, (2) by using a tape measure to determine the square footage of panels and the lineal footage of posts (nominal dimensions for wood materials), as shown in the Bid Schedule. No deduction will be made for rounded corners.

02890.4.2 Measurement for sign removal shall be made by counting the number of sign assemblies removed and disposed of as listed in the Bid Schedule. An assembly shall be considered as one sign when its materials are integrally connected at a single location.

02890.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for each pay item shown in the Schedule of Items:

PAY ITEM	UNIT
Wood Posts *(Size*)	Lineal Foot
Steel Posts *(Size)*	Lineal Foot
Aluminum Posts *(Size)*	Lineal Foot
Aluminum Sign Panels *(Size or Description)*	Square Foot
Plywood Sign Panels *(Size or Description)*	Square Foot
Steel Sign Panels *(Size or Description)*	Square Foot
Delineators	Each
Sign *(Description or Identification)*	Each
Sign Removal *(Description)*	Each
Sign & Post(s) Installation Only	Each

02900.1 DESCRIPTION

This section covers providing materials, equipment and labor necessary for installing topsoil, turf, trees, shrubs, grasses, forbs, field seeding, re-seeding, fertilizer, mulch, and soil amendments.

02900.1.1 RELATED WORK

Not used.

02900.1.2 SUBMITTALS

The Contractor shall submit for approval product data and seed mixtures in accordance with the requirements of Section 01300.

02900.1.3 DEFINITIONS

Not used.

02900.2 MATERIALS

02900.2.1 TOPSOIL

Topsoil shall be obtained from local sources, and shall have similar soil characteristics to those of the soil at the location where it is to be used. Topsoil shall be obtained from well-drained sites where it occurs to a depth of not less than 4 inches, and it shall not be obtained from bogs or marshes. Topsoil shall be fertile, friable, natural loam, reasonably free of subsoil, clay lumps, brush, weeds, litter, roots, stumps, stones larger than 2 inches in any dimension, or any other material which would inhibit the germination of seeds or the growth of the cover crop.

02900.2.2 TURF SEED

If not otherwise required in the Contract Documents, seed for turf sod shall be composed principally of Kentucky bluegrass (Poa pratensis), testing 99.9% pure live seed (PLS), or as approved. Other acceptable varieties include Merion, Baron, Fylking, Tall Fescue, and Brome.

02900.2.3 TURF SOD

Turf sod shall be vigorous, viable, strongly rooted sod, not dormant or less than 2 years old, free of weeds, undesirable native grasses, insect infestations, and fungus. It shall be machine cut to a pad thickness of 1 inch ($\pm$ 0.33 inch).

02900.2.4 TREES AND SHRUBS

02900.2.4.1 NURSERY GROWN - Trees and shrubs shall be nursery-grown, with botanical and common names of plants true to the approved names given in the latest edition of "Hortus", and shall meet the requirements of the American Standard for Nursery Stock adopted by the American Association of Nurserymen. Plants shall be sound, healthy, vigorous, symmetrically proportioned, well branched, densely foliated when in leaf, free of disease, insect pests, eggs, and larvae and shall have well developed root systems.

02900.2.4.2 ROOT BALLS AND PRUNING - Root balls shall be protected at all times from sun, drying winds and frost. Plants shall not be pruned prior to delivery. If balled and burlapped plants are not installed immediately upon delivery, they shall be set on the ground and protected with moist soil or wet mulch.

02900.2.4.3 WARRANTY - Trees and shrubs shall be warranted for a period of 1 year after Substantial Completion, against death and unsatisfactory growth, except in cases resulting from Owner's neglect, abuse by others or natural phenomena. Unacceptable plant material shall be replaced at end of warranty period. Only one replacement is required.

02900.2.4.4 FIELD SEED MIX

The seed mix listed below is suggested as a standard for field seeding when no other information is available. However, seed mix requirements can vary widely from area to area, and the Contractor shall contact the local office of the Natural Resources Conservation Service (NRCS) to obtain an appropriate seed species mix and application rate for the location in question. The Contractor shall follow the directions of the NRCS, the Engineer, and the property owner in doing field seeding.

SUGGESTED FIELD SEED MIX

Species	**Amount** (%)
Nardan Crested Wheatgrass	30
Russian Wild Rye	20
Y.B. Sweet Clover	15
Slender Wheatgrass	10
Oahe Intermediate Wheatgrass	10
Fairway Crested Wheatgrass	5
Western Wheatgrass	4
Other	6

02900.2.5 RESEEDING AND REVEGETATING

As with the field seed mix, non-field seed mix and/or vegetation requirements are usually area sensitive. Different government agencies, such as the Forest Service or the Bureau of Land Management, may have separate seed mix and vegetation requirements within the same area. The Contractor shall contact the respective property owner at their local office, address, or telephone number to obtain the appropriate reseeding and revegetating requirements and follow the same, in concurrence with the Engineer, in acquiring the appropriate seed and vegetation.

02900.2.6 MULCH

02900.2.6.1 TREE AND SHRUB MULCH - Tree and shrub mulch shall consist of well-aged fibrous or shredded bark, old sawdust, pine needles or leaf mold.

02900.2.6.2 FIELD SEED MULCH - Field seeding mulch shall be certified weed free small grain straw or native hay.

02900.2.6.3 HYDRAULIC MULCH - Hydraulic seeding mulch shall consist of pigments and wood cellulose fiber or paper pulp and shall form a blotter-like ground cover with moisture absorption and percolation properties. It shall have the ability to cover and hold the seed in contact with the topsoil, yet not inhibit the penetration of seedlings through it.

02900.3 CONSTRUCTION REQUIREMENTS

02900.3.1 SCOPE OF REQUIREMENTS

The Contractor shall furnish all equipment, labor, topsoil, seed, seed mixes, turf, shrubs trees or other materials required to landscape, re-seed, or re-vegetate all areas disturbed by the Work, as

required by the Drawings and these Specifications. The disturbed area shall be kept as small as possible.

02900.3.2 EROSION CONTROL

The condition of landscaped, re-seeded and re-vegetated areas shall be checked to determine the effectiveness of erosion control methods and materials. Checks will be made upon project completion, at three months following project completion, and at nine months following project completion. Any modifications or repairs required by the Engineer shall be promptly performed by the Contractor, at no additional cost to the Owner.

02900.3.3 TOPSOIL

02900.3.3.1 REMOVAL OF TOPSOIL - Topsoil to be saved shall be carefully removed to a depth of 24 inches, or to the actual depth of the existing layer, which ever is less, and set aside in a separate location. It shall not be mixed with the remainder of excavated material.

02900.3.3.2 REPLACEMENT OF TOPSOIL - When site work conditions permit, topsoil shall be spread as shown on the Drawings. The minimum depth of topsoil shall be 6 inches over all designated areas. Topsoil shall be fine graded to a firm even surface, matching existing slopes, with no lumps or stones present. The topsoil shall be prepared to a good condition, not muddy or hard, and shall be scarified to a friable condition if it is hard before turf is placed.

02900.3.3.3 PROTECTION AGAINST EROSION - Areas where topsoil has been spread shall be protected against erosion.

02900.3.4 TURF SEED

02900.3.4.1 SEEDBED PREPARATION - Where required, turf seed shall be installed as specified herein. Seedbed preparation shall be accomplished by spreading peat moss or manure uniformly at a rate of 3 cubic yards per 1000 square feet and worked into the soil by light tilling.

02900.3.4.2 APPLICATION - Seed shall be applied at a rate of 2 pounds per 1000 square feet using a drop (band) type spreader unless otherwise approved by the Engineer. The seed shall be divided into two halves and then distributed, half in north/south directions and half in east/west directions. Seed shall be raked into the soil, a layer of mulch shall be applied, and then lightly watered, at least four times daily for two weeks, or until the seed germinates.

02900.3.5 TURF SOD

02900.3.5.1 INSTALLATION - Where required, turf sod shall be laid across slopes such that butt joints alternate. Sod pieces shall be fitted tightly together so no joint is visible and then firmly and evenly hand tamped. The sod shall then be rolled with a 150-pound roller to level and seal all seams.

02900.3.5.2 WATERING - After rolling, sod shall be watered until water soaks into underlying topsoil to a depth of not more than 3 inches. For grades of 50% slope or steeper, the sod shall be secured with wooden pegs driven flush with the soil portion of the sod and 2 feet maximum on center.

02900.3.5.3 MOWING - Prior to Substantial Completion, sod shall be mowed as required to maintain a maximum height of 2 1/2 inches.

02900.3.6 TREES AND SHRUBS

02900.3.6.1 LOCATION - When required trees and shrubs shall be installed, as specified herein, at locations designated on the Drawings. Trees and shrubs to be saved and replanted shall be carefully removed, set aside, protected and preserved until they can be safely replanted.

02900.3.6.2 PREPARATION OF PLANTING PIT - Tree and shrub pits shall be five times the diameter of the root ball. The bed shall be prepared by loosening the soil with a tiller or shovel to a depth of 12 inches. Topsoil and organic matter shall then be added and distributed uniformly within the planting bed as necessary. The Contractor shall not proceed with planting until the pit locations and bedding are approved by the Engineer.

02900.3.6.3 PLANTING - The plant shall be set in the center of a hole of the proper size, plumb and straight. Burlap, ropes and all wire and other materials shall be removed, and then the excavated soil shall be returned to the hole and gently packed around the root ball. The planting shall be flooded with water to promote additional soil consolidation. The Contractor shall give care that, after settling, the top of the root collar shall be even with the adjacent finished grade A 2-inch layer of mulch shall be applied around the base of the tree, to extend 2 feet in radius beyond the root ball.

02900.3.6.4 SUPPORT - Trees shall be guyed with two wires anchored securely to steel posts not less than 5 feet from the trunk, and directly opposite each other. The trees shall be protected from direct contact with the wires.

02900.3.6.5 PRUNING - Each plant shall be pruned with clean, sharp tools, to remove suckers and broken, badly bruised or dead branches. Tree trunks shall be wrapped with Tubex or equivalent translucent material unless directed otherwise by the Engineer.

02900.3.6.6 WATERING - Trees and shrubs shall be watered and maintained until Substantial Completion and defective work shall be corrected as soon as it becomes apparent and as weather and season permit.

02900.3.7 FIELD SEEDING

Field seeding shall be accomplished using one of the following methods.

02900.3.7.1 BROADCAST - Broadcast seeding shall only be applied after October 15 and prior to April 15, unless authorized otherwise and directed in writing by the Engineer. No seed bed preparation will be required for this seeding method.

02900.3.7.2 DRILLING - Drilling shall be set forth in uniform rows with spacing not to exceed 8 inches and the depth set correctly for the type of seed being drilled. The minimum distribution rate shall be 20 pounds per acre, and may be more if so recommended by the local Soil Conservation Service.

02900.3.7.3 HYDRAULIC - For hydraulic seeding the Contractor shall use equipment designed for such work. Seed and water shall be uniformly applied to the areas scheduled to be seeded. Fertilizer, water and approximately 1 ton per acre of hydraulic mulch shall be homogeneously mixed and uniformly applied to seeded areas.

02900.3.8 RESEEDING AND RE-VEGETATING

02900.3.8.1 RE-SEEDING - Reseeding of areas disturbed by the Work shall be accomplished with grasses compatible with the pre-construction vegetation. The Contractor shall consult the local office of the U.S. Forest Service, Bureau or Land Management, Soil Conservation Service, or other applicable affected agency, for appropriate seed species and application rates. Unless otherwise

directed by the Engineer or these Specifications, reseeding shall be accomplished by broadcast seeding in accordance with this section.

02900.3.8.2 RE-VEGETATING - Re-vegetation of areas disturbed by the Work shall be accomplished with started trees and shrubs, compatible with the pre-construction vegetation, and is performed in addition to reseeding as discussed in paragraph 02900.3.8.1 above. When re-vegetation is required, the Contractor shall consult the local office of the applicable affected agency, for appropriate species and instructions.

02900.3.9 MULCH

Mulch shall be incorporated as prescribed on the Drawings and in these Specifications. Where the slope exceeds 10%, the Contractor shall use a tie down mulching material.

02900.4 METHOD OF MEASUREMENT

02900.4.1 LUMP SUM - Lump sum measurement for landscaping shall include all grading, soil preparation, planting, furnishing materials and plants in accordance with the Drawings and these Specifications when shown as a single item in the Bid Schedule.

02900.4.2 SEPARATE MEASUREMENT - When and if applicable, separate measurements for topsoil, turf seeding, turf sod laying, reseeding, re-vegetating, mulching and planting of trees and shrubs shall be made in the units shown and as identified in the Bid Schedule.

02900.5 BASIS OF PAYMENT

The accepted quantity(s) shall be paid for at the contract unit price for:

PAY ITEM	UNIT
Landscaping	Lump Sum
Topsoil	Square Yard
Turf, Seed	Square Foot
Turf Sod	Square Foot
Trees & Shrubs	Each
Field Seeding	Acre
Re-seeding	Acre
Mulch	Acre

SPECIAL PROVISION

LANDSCAPING	SECTION SP02900

Modify the following sections as follows:

02900.2.4.3 WARRANTY – Shrubs and Forbs shall be warranted for a period of 2 years after Substantial Completion, against death and unsatisfactory growth, except in cases resulting from Owner's neglect, abuse by others or natural phenomena. Unacceptable plant material shall be replaced at end of warranty period. Only one replacement is required.

02900.2.4.4 FIELD SEED MIX

Field seed mix shall be as specified in the BLM Right of Way Grant Serial Number WYWY105843389(WYW190164) contained in the contract documents.

02900.3 CONSTRUCTION REQUIREMENTS

02900.3.4.2 APPLICATION - Seed shall be applied at a rate of 17 pounds per acre using drill as specified in the BLM Right of Way Grant Serial Number WYWY105843389(WYW190164) contained in the contract documents.

02900.3.6 SHRUBS and FORBS

Shrubs and Forbs shall be planted as specified in the BLM Right of Way Grant Serial Number WYWY105843389(WYW190164) contained in the contract documents.

02950.1 DESCRIPTION

This section covers furnishing and installation of geotextile fabric of the type and configuration shown on the Drawings or specified in the Contract Documents.

02950.1.1 RELATED WORK

Section 02200 - Trench Excavation and Backfill
Section 02202 - Roadway Excavation and Embankment
Section 02201 - Earthwork for Structures

02950.1.2 SUBMITTALS

The Contractor shall submit manufacturer's descriptive literature, which identifies and describes applications, physical properties and characteristics of geotextile filter fabric materials to be used for this contract, in accordance with Section 01300 of these Specifications. Upon request of the Engineer, the Contractor shall supply samples for examination or testing.

02950.1.3 DEFINITIONS

Not used.

02950.2 MATERIALS

02950.2.1 FOR RIPRAP AND DRAINAGE CHANNELS

Unless shown otherwise on the Drawings or in Contract Documents, filter fabric materials for installation under riprap in drainage channels, or for lining structural footing drainage components shall be TREVIRA Spunbond type 011/250, MIRIFI 180/N or an approved equal with the following characteristics:

FILTER FABRIC CHARACTERISTICS

Grab Tensile Strength, ASTM D-4632	210 lb.
Elongation at Failure, ASTM D-4632	50%
Trapezoid Tear Strength, ASTM D-4533	75 lb.
Puncture Strength, ASTM D-4833	95 lb.
Mullen Burst Strength, ASTM D-3786	360 psi.
Permeability - k, ASTM D-4491	0.3 cm/sec.
Permittivity, ASTM D-4491	1.4 sec^{-1}
Vertical Water Flow, ASTM D-4491	110 gpm/ft^2
Apparent Opening Size*, ASTM D-4751	0.210 mm

*Maximum Opening Size

02950.2.2 FOR EMBANKMENTS AND FOUNDATIONS

Requirements for geotextile fabric materials used for embankment or foundation stabilization other than that specified above will be provided in the Special Provisions of the Contract Documents.

02950.3 CONSTRUCTION REQUIREMENTS

Filter fabric materials shall be installed in strict accordance with the manufacturer's instructions and recommendations. Care shall be taken at all times to prevent puncturing or tearing of the

fabric materials during placement under embankment or riprap materials. Joints of fabric sheets shall be lapped in accordance with the manufacturer's instructions and fastened securely in place with fasteners to prevent gaps and misalignment during coverage with earth materials.

02950.4 METHOD OF MEASUREMENT

02950.4.1 Geotextile fabrics will be considered incidental to installation of riprap and drainage gravel envelopes and no separate measurement shall be made.

02950.4.2 When shown separately as an item in the Bid Schedule, geotextile fabric shall be measured to the nearest tenth square yard determined from field measurements of surface areas on which each type of the fabric is installed, excluding overlaps.

02950.5 BASIS OF PAYMENT

02950.5.1 When geotextile fabric materials are furnished and installed incidental to other items in the Bid Schedule, no separate payment shall be made.

02950.5.2 When shown in the Bid Schedule as a separate item, the accepted quantities will be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Geotextile Fabric (*Type*)	Square Yard

SPECIAL PROVISION

EROSION AND SEDIMENT PREVENTION — SECTION SP 02975

02975.1 DESCRIPTION

The Contractor shall furnish and install the Erosion and Sediment Transport Best Management Practices as shown on the plans and as directed by the Contractor's storm water pollution prevention plan (SWPP).

02975.2 EROSION AND SEDIMENT TRANSPORT BEST MANAGEMENT PRACTICES

02975.2.1 WATTLES

The Contractor shall furnish and install wattles as shown on the Drawings and/or directed by the Engineer.

02975.2.2 EPHEMERAL WASH CROSSING

The Contractor shall furnish and install ephemeral wash crossings as shown on the Drawings and/or directed by the Engineer.

02975.2.3 STRAW BALE DIKE

In lieu of wattles, the Contractor may furnish and install straw bale dikes as shown on the Drawings and/or directed by the Engineer.

02975.2.3 FILTER FABRIC FENCE

The Contractor shall furnish and install filter fabric fences at locations where down slope properties receive precipitation runoff from the project right of way and/or directed by the Engineer.

02975.3 METHOD OF MEASUREMENT

02975.3.1 WATTLES – Measurement for this bid item shall be made by the lump sum for the wattles installed in the locations and at the spacing and lengths depicted on the drawings.

02975.3.2 EPHEMERAL WASH CROSSINGS – Measurement for this bid item shall be made by counting each installed, acceptable wash crossing to include the gabion baskets, filter fabric and polystyrene insulation.

02975.3.3 STRAW BALE DIKE – Measurement for this bid item shall be made by the lineal foot measured along the longitudinal axis of furnished and installed straw bale dike.

02975.3.4 FILTER FABRIC FENCE – Measurement for this bid item shall be by the lineal foot for installed and accepted filter fabric fence.

02975.4 BASIS OF PAYMENT

Work completed under these bid items shall be paid for at the contract unit price as listed in the bidder's proposal and shall be considered complete compensation for furnishing and installing of the Erosion and Sediment Transport Best Management Practices as shown on the plans, including but not limited to materials, labor, and equipment.

The accepted quantity(s) shall be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Wattles	L.S.
Ephemeral Wash Crossings	Each
Straw Bale Dike	L.S.
Filter Fabric Fence	Lineal Foot

DIVISION 3

CONCRETE

SUNRISE
ENGINEERING

03050.1 DESCRIPTION

This section contains requirements for Portland cement concrete materials and concrete mix designs.

03050.1.1 RELATED MATERIALS AND WORK

Section 03100 - Concrete Forming, Finishing and Curing
Section 03200 - Concrete Reinforcement
Section 03300 - Concrete Structures and Slabwork
Section 03500 - Pre-Cast Concrete Components
Section 03600 - Grout and Mortar

03050.1.2 SUBMITTALS

03050.1.2.1 PROPOSED MIX DESIGN - Each proposed mix design shall be submitted at least 14 days prior to its use in the Work. Indicate whether mix has been designed for pumping. Mix design submittals shall include the following information:

- Water-cementitious materials ratio (w/cm).
- Proportion of materials in the mix.
- Source and type of cement.
- Analysis of water to be used, unless potable.
- Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used and the resulting change in placement times.
- Slump, air content, and temperature of samples.
- Unit weights of fresh and dry light weight concrete.
- Any applicable and verifiable test documentation available if the submitted mix design has been used by the CONTRACTOR in prior projects.

03050.1.2.2 AGGREGATE TEST REPORT - Aggregate Test Report (submit for each aggregate source):

- Data of test analysis.
- Sieve analysis.
- Organic impurities.
- Sodium sulfate soundness test.
- Reactivity of aggregate.
- Complete identification of source of aggregate.

03050.1.2.3 CHANGES IN MIX DESIGN - After the design of the mix or mixes has been approved by the Engineer, neither the source, character, or grading of the aggregate, nor the brand or type of cement shall be changed, without 48 hours written notice to the Engineer. Should such changes become necessary, no concrete containing such new or altered materials shall be placed until the revised mix design has been submitted to the Engineer for review and approval.

03050.1.3 DEFINITIONS

Workability - The ease of placing, consolidating and finishing freshly mixed concrete.

Consolidation - Hand rodding or mechanically vibrating actions which give freshly mixed concrete the characteristics of a thick fluid to minimize voids when set.

Hydration - The chemical reaction between water and calcined limestone resulting in the excellent bonding properties of the cement particles with one another and with the aggregates in the mix.

Curing – The process necessary to provide adequate moisture, temperature, and time to allow concrete to achieve the desired properties for its intended use. The time is generally construed to mean the period required for concrete to attain 70 percent of the specified compressive strength, which is about seven days.

Strength - The maximum resistance of a mortar or concrete specimen to axial compressive loading expressed in psi.

Admixtures - Chemical additives to concrete mixes intended to adjust setting time, reduce water demands, increase workability and entrain air.

Air Entrainment - Introduction of chemicals to concrete mixtures which produce microscopic air bubbles which improve the workability and ability to resist deterioration due to freezing.

Reinforcement - Materials formed or mixed in concrete mixtures, to increase the ability of the concrete to withstand loading when set (hardened).

Water-Cementitious Materials Ratio - The weight of the water divided by the weight of the cement plus supplementary cementitious materials in a concrete mixture.

Tempering - The addition of water to mixed concrete after arrival on site.

03050.2 MATERIALS

03050.2.1 CEMENT

03050.2.1.1 SITE-PLACED CONCRETE - For site-placed concrete, cement shall be Type II (low alkali) cement, meeting requirements of ASTM C-150, unless otherwise directed by the Engineer or these Specifications. Do not use cement containing lumps, or cement which has partially set. Do not mix cements originating from different sources or manufacturers.

03050.2.1.2 PRE-CAST CONCRETE - For pre-cast concrete, cement shall be Class 5000 (minimum) in accordance with ACI 318 for units to be installed above ground. For units installed below ground, concrete shall be Class 4000 in accordance with ASTM C 478 and ASTM C 858.

03050.2.2 WATER

Shall be potable or water which meets the requirements of ASTM C1602.

03050.2.3 REINFORCEMENT

Shall be in accordance with Section 03200 of these Specifications.

03050.2.4 ADMIXTURES

03050.2.4.1 AIR ENTRAINMENT - Air entrainment of concrete shall meet the requirements of AASHTO M-154 (ASTM C-260).

03050.2.4.2 PLASTICIZERS - Water reducing agents (plasticizers) and set retarding agents shall meet the requirements of AASHTO M-194 (ASTM C-494). Only types A or F will be approved as water reducing agents, only types C and E will be approved as set accelerating agents, and only types B,

D, or G will be approved as set retarding agents. Water reducing, set accelerating, and set retarding agents shall be pre-measured and added in strict accordance with manufacturer's instructions. Calcium chloride will not be approved.

03050.2.4.3 FLY ASH - Pozzolan (fly ash) may be used to replace a percentage of cement in the mix design in accordance with ASTM C-618, Class C and Class F, under the following conditions:

- The minimum required cement content shall be expressed in the design formula before replacement calculations are made.
- The amount of Portland cement replaced by pozzolan shall not exceed 15% for exterior concrete (concrete exposed to weather) and 20% for interior concrete.
- The ratio of replacement by weight of pozzolan to cement shall be 1.25 to 1.0.
- Loss of ignition of pozzolan shall be less than 3 percent, and the water requirement shall not exceed 100 percent.
- All other requirements of this Section still apply.
- Mix designs including trial batches are required for each aggregate source and for each concrete class.
- See also Subsection 03050.2.6.4 below.

03050.2.5 AGGREGATE

03050.2.5.1 AGGREGATE RATIO - The combined weight of coarse and fine aggregate material passing the No. 200 sieve shall not exceed 1.75 percent of the total weight of aggregate. The ratio of coarse to fine aggregate shall not be less than one (1) nor more than two (2), nor shall the amount of coarse aggregate be great enough to cause difficulty in concrete placement or honeycombing in the structure.

03050.2.5.2 COURSE AGGREGATE - Coarse aggregate shall comply with AASHTO M-80, using gradations from the following table:

COARSE AGGREGATE GRADATIONS

	Percent Passing (by weight)							
	Sieve Size							
Aggregate Size	2½”	2”	1½”	1”	3/4”	½”	3/8”	No. 4
2” to No. 4	100	95-100		35-70		10-30		0-5
1½” to No. 4		100	95-100		35-70		10-30	0-5
1” to No. 4			100	95-100		25-60		0-10
3/4” to No. 4				100	90-100		20-55	0-10

Maximum coarse aggregate gradation shall not be larger than 1/5 of the narrowest dimension between sides of forms; shall not be larger than 1/3 the depth of slabs; shall not be larger than 3/4 of the minimum clear distance between reinforcing bars or between bars and forms, whichever is less; and shall not be larger than 2 inches.

The maximum percentage by weight of deleterious substances allowed in coarse aggregate materials shall be:

DELETERIOUS SUBSTANCES ALLOWED IN COARSE AGGREGATE

Substance	Percent
Soft fragments	2.0
Coal and lignite	0.3
Clay lumps	0.3
Other deleterious substances	2.0

03050.2.5.3 FINE AGGREGATE - Fine aggregate shall comply with AASHTO M-6 using gradations from the following table:

FINE AGGREGATE GRADATIONS

Sieve Size	Percent Passing (by weight)
3/8-inch	100
No. 4	95 to 100
No. 16	45 to 80
No. 50	10 to 30
No. 100	2 to 10

The maximum percentage by weight of deleterious substances allowed in fine aggregate shall be:

DELETERIOUS SUBSTANCES ALLOWED IN FINE AGGREGATE

Substance	Percent
Coal and lignite	0.3
Clay lumps	0.5
Other deleterious substances	2.0

03050.2.5.4 AGGREGATE SOUNDNESS AND REACTIVITY - As determined in accordance with ASTM C-88, potentially deleterious aggregates shall not be used unless service records have shown the aggregates to be innocuous, and the Engineer subsequently approves them in writing.

03050.2.6 MIXING REQUIREMENTS

03050.2.6.1 CONCRETE CLASSIFICATIONS - Mixing requirements for the specific concrete classes indicated on the Drawings and/or within these Specifications shall be as follows:

CONCRETE CLASSIFICATIONS

Concrete Properties	Concrete Classifications			
	5000	4000	3500	2000
Coarse Aggregates (see requirements shown below)				
Maximum Water/Cement Ratio (gal/sack)	5.0	6.0	6.5	8.0
Minimum Cement Content (sacks/CY)	***	***	6.0	4.5
Slump (inches)**	2 to 4	2 to 4	2 to 4	2 to 5
Air Content (percent)	5.0 to 7.5	5.0 to 7.0	5.0 to 7.0	3.0 to 5.0
Required Average 28 Day Compression Strength Test (psi)****	5200	4200	3700	2200
Required Minimum 28 Day Compression Strength Test (psi)****	4800	3800	3300	1800

Notes: * All concrete installed shall be Class 3500 unless otherwise required in the Contract Documents.
** When water reducing agents are not used.
*** Cement content shall be appropriate to produce a mixture meeting the requirements for water/cement ratio and workability for the specific job conditions.
**** One compressive strength test shall consist of the average strength of two cylinders in the test sample.

03050.2.6.2 REQUIRED AVERAGE DAY COMPRESSIVE STRENGTH - The CONTRACTOR shall furnish and install concrete that will produce a Required Average (28) Day Compressive Strength as shown on the table above. The average of any three consecutive (28) day strength tests shall not fall below the required Minimum (28) Day Compressive Strength Test shown. If the average of any three consecutive tests falls below the Required Minimum, the average strength of the concrete shall be increased at the CONTRACTOR's expense by increasing the cement content.

03050.2.6.3 WATER REDUCING AGENTS - When water reducing agents (plasticizers) are used in the concrete mixtures shown above, maximum slump requirements may be increased to 5 inches with low range water reducers and to 8 inches with high-range water reducers.

03050.2.6.4 FLY ASH - When fly ash is used in the mix, the cement in the water/cement ratio denotes the cement and fly ash combined. Cement shall be introduced into the batcher before the fly ash.

03050.2.6.5 CONCRETE PLACED IN WATER - For concrete deposited in water, add one additional bag of cement per cubic yard more than the design requires for concrete placed above water or add an anti-washout admixture, approved by the submittal process, per manufacturer recommendations.

03050.3 CONSTRUCTION REQUIREMENTS

03050.3.1 STORING CEMENT

Bagged and bulk cement shall be stored in weatherproof enclosures to exclude moisture and contaminants.

03050.3.2 STOCKPILING AND HANDLING AGGREGATE

03050.3.2.1 CLEAN SITE - The site provided for stockpiling aggregates shall be clean with adequate space to provide separate stockpiles for coarse and fine aggregates.

03050.3.2.2 WASHING AGGREGATE - Washed aggregates shall be allowed to drain to a uniform moisture content, and stockpiles shall be built at least 48 hours before use.

03050.3.2.3 HEIGHT - Aggregate shall not be dropped more than 10 feet from the conveyor, nor shall cone shaped piles more than 10 feet high be built.

03050.3.2.4 STOCKPILE LAYERING - Stockpiles shall be built in thin layers (5 feet maximum) in such manner, to prevent spillage of aggregate over the sides of the stockpile.

03050.3.2.5 FROZEN MATERIALS - Stockpiles containing snow, ice, or frozen materials shall not be used.

03050.3.3 BATCHING MATERIALS

03050.3.3.1 SCALES - The CONTRACTOR shall provide scales or arrange for usage of scales that have been certified by State agencies within the past 12 months.

03050.3.3.2 BATCH MIXERS - Batch mixers shall be operated at the manufacturer's recommended drum speed. Drums and blades shall be kept free from excessive cement and mortar build up. Cement shall be introduced into the batcher before fly ash, and all admixtures shall be introduced to the mixer separately.

03050.3.3.3 CENTRAL MIXING PLANT - At central mix plants, all materials shall be mixed for at least 80 seconds at recommended drum speed. When more water is added to the cement mixture, the materials shall be mixed for an additional 30 seconds.

03050.3.3.4 MIXING PERIOD - The mixing period for truck mixers shall be maintained between 70 and 100 revolutions at mixing speed. Maintain a minimum of 90 revolutions for front end discharge trucks. Concrete mixing shall be completed before the truck leaves the batch plant yard.

03050.3.3.5 WATER REDUCING AGENTS - If water reducing agents are added at the site, they shall be added using injection equipment capable of rapidly and uniformly distributing the admixture. Prior to discharge, the concrete shall be mixed for a minimum of 5 minutes at a drum rate not less than 12 rpm or more than 15 rpm discharge.

03050.3.4 HEATING AGGREGATE AND WATER

03050.3.4.1 HEATING EQUIPMENT - When approved by the Engineer, the CONTRACTOR, at its own expense, may provide and operate heating equipment to heat aggregate and water because of cold weather conditions. All heating operations shall meet temperature limitations provided in these Specifications and shall conform to Standard ACI 306. The CONTRACTOR shall ensure that excessive heat does not cause "flash set" when the cement is added.

03050.3.4.2 UNIFORM HEATING - Aggregates shall be heated uniformly with steam or dry heat. Water shall be heated to between 70°F and 150°F when introduced into the mixer. Measures shall be taken to prevent overheating and hot spot development. No combustion products (ash, smoke, gas and etc.) shall contact the aggregate.

03050.3.5 COOLING CONCRETE MIXTURE

03050.3.5.1 COOLING EQUIPMENT - When approved by the Engineer, the CONTRACTOR, at its own expense, may provide and operate equipment to refrigerate water, provide ice or cool aggregate, to mix concrete due to hot weather conditions. All methods of cooling shall meet the requirements of ACI 305.

03050.3.5.2 USE OF ICE - When ice is introduced into the mixer, it shall be accounted for as mix water in the batching process and it shall be in such form as to be completely melted and dispersed throughout the mix at the completion of the mixing time. The mixing time shall be held to the minimum practicable, consistent with producing concrete meeting the specified requirements.

03050.3.6 CONCRETE TRANSPORT

03050.3.6.1 TRUCKS - Concrete mixtures shall be transported only in conventional transit mixers or agitator trucks with rating plates that are readable. Trucks shall be equipped with visible water meters and revolution counters and shall be capable of measuring all water introduced into the mixing drum.

03050.3.6.2 LOADING - Trucks shall not be loaded:

- In excess of their rated mixing capacity, or
- In excess of 63 percent of the drum gross volume, or

- In quantities less than 2 cubic yards

03050.3.7 CONCRETE TEMPERING

03050.3.7.1 ADDING WATER – Concrete may be tempered through the addition of water under the following conditions:

- Water shall be added within specified time limits. At no time shall water be added after testing has taken place.
- Wherever possible, water shall be added after the truck leaves the batch plant.
- Water shall not be added in excess of the water/cement ratio or in excess of that specified on the batch tickets.
- The mixing drum shall be rotated at least 30 revolutions at the manufacturer's recommended mixing speed when water is added, OR, addition of water for tempering shall be followed by 3 minutes of mixing at mixing speed prior to discharge.
- Water shall not be added after 1/2 cubic yard or more of concrete has been discharged from the drum.

03050.3.7.2 LOW SLUMP - When concrete arrives at the site with a slump below specification, the CONTRACTOR may temper the mix up to the maximum approved water/cement ratio, provided:

- The mix design allows for on-site water addition;
- The amount of water added is accurately measured to the nearest gallon;
- The maximum slump is not exceeded; and
- The person adding water is approved to do so by the Engineer and the concrete supplier.

03050.3.7.3 TEMPERING WITH PLASTICIZER - Do not deliver concrete containing plasticizer to the site unless the batch delivery ticket displays water/cement ratio prior to plasticizer addition. Tempering with plasticizer after delivery time window expiration shall not be allowed.

03050.3.8 CONCRETE PLACEMENT

Shall be in accordance with Section 03300.

03050.3.9 CONCRETE SAMPLING AND TESTING

03050.3.9.1 PROCEDURE -The CONTRACTOR shall be responsible for all required sampling and testing of concrete during construction, including slump, air entrainment, strength and temperature. All testing for concrete used on this project shall be performed by an independent certified testing facility and its personnel. The CONTRACTOR shall obtain the Engineer's approval of the independent certified testing facility at least ten (10) days before any project field work is started. Approval of the CONTRACTOR's independent certified testing facility shall be based on a statement of qualifications, which shall be submitted to the Engineer. All costs for sampling and testing in accordance with the project specifications shall be paid by the CONTRACTOR.

03050.3.9.2 SAMPLING FREQUENCY - Concrete sampling frequency shall be as noted below:

- A minimum of one air test (ASTM C-231 or C-173) and one slump test (ASTM C 143) shall be performed for each placement over 5 cubic yards. At least one air and one slump test shall be performed for each additional load of concrete placed.

- For each test, the concrete temperature and the time shall be verified and recorded. Air and slump test results shall be recorded on batch delivery tickets.
- If an air test fails, immediately retest the same load. The concrete shall be rejected if the second air test fails to meet specified requirements. If the second air test meets specified requirements, a third test will be performed to establish concrete acceptance or rejection.

- If the slump for an individual load cannot be corrected by tempering within the mix design requirements and within the requirements of these Specifications, the load shall be rejected.

- The testing facility shall prepare test cylinders for strength testing in accordance with ASTM C-31 and execute compressive strength testing in accordance with ASTM C-39.

- At least one strength test shall be performed for each placement over 5 cu. yd., and one additional test for every 50 cu. yards of concrete placed or more frequently at the Engineer's discretion. The number of cylinders for a valid 28-day compressive strength test shall be determined in accordance with ACI 301 and 318. If the cylinders are 6”x12”, two are adequate for a 28-day test. If the cylinders are 4”x8”, three are required. One cylinder from each test may be set aside at the CONTRACTOR's request for strength verification prior to form removal. The average compressive strength of the two or three cylinders constitutes one compressive strength test.

- The CONTRACTOR shall provide space in the work area and protect sample cylinders from disturbance for 24 hours after they are cast or until they are moved from the work area by testing laboratory personnel or under the direction of the Engineer.

- The average compressive strength shall meet the requirements shown in the table in Section 03050.2.6.1 for the class of concrete placed.

03050.4 METHOD OF MEASUREMENT

Measurement for concrete placed in accordance with these Specifications shall be as described in Section 03300.

03050.5 BASIS OF PAYMENT

Acceptable quantities of concrete, when measured separately, shall be paid for at the contract unit prices described in Section 03300.

SPECIAL PROVISION

PORTLAND CEMENT CONCRETE	SECTION SP03050

Replace the following Sections;

03050.2 MATERIALS

03050.2.1 CEMENT

03050.2.1.1 SITE-PLACED CONCRETE - For site-placed concrete, cement shall be Type V cement, meeting requirements of ASTM C-150, unless otherwise directed by the Engineer or these Specifications. Do not use cement containing lumps, or cement which has partially set. Do not mix cements originating from different sources or manufacturers.

03050.2.6.1 CONCRETE CLASSIFICATIONS – Concrete shall be Class 4000 for all structural building and vault components. Concrete for thrust blocks, pipe anchors and post bases shall be class 3500.

03100.1 DESCRIPTION

Includes furnishing materials, accessories and labor required to form, finish and cure interior and exterior cast-in-place concrete.

03100.1.1 RELATED WORK

Section 03050 - Portland Cement Concrete
Section 03200 - Concrete Reinforcement
Section 03300 - Concrete Structures and Slabwork
Section 03500 - Precast Concrete Components
Section 03600 - Grout and Mortar

03100.1.2 SUBMITTALS

03100.1.2.1 SHOP DRAWINGS - When called for in these Specifications, the CONTRACTOR shall furnish shop drawings of forms for specific concrete items. Such drawings shall show general construction of forms, jointing, location of ties and other items affecting visibility.

03100.1.2.2 FORM RELEASE AGENT - Where concrete surfaces are scheduled to receive special finishes or applied coverings, which may be affected by the form release agent, submit manufacturer's instruction for use of agent.

03100.1.2.3 CHEMICAL HARDENER - Submit name, type, chemical analysis and manufacturer's recommended rate of application for chemical hardener, when specified.

03100.1.2.4 CURING COMPOUNDS - Submit manufacturer’s specifications, test information, ingredients, certification, and installation recommendations for curing compounds. This information may become the basis of acceptance or rejection of the work cured by the material used. See also the submittal requirement under Membrane Curing Compounds in 03100.3.6.2 herein.

03100.1.3 DEFINITIONS

Shoring - The framework installed to support formwork.

Re-Shoring - Framework installed or not removed which serves as support for form-work after concrete sets and there is less need for the support.

Form Coatings - Compound coated on forms, preventing concrete surface bonding to the forms.

Curing Compound - Liquid medium sprayed or coated on concrete to retain moisture.

03100.2 MATERIALS

03100.2.1 FORM TIES AND SPREADERS

Shall be removable or snap-off metal, designed to prevent form deflection and to prevent spilling on concrete surfaces upon removal. Form ties shall be factory fabricated. Field fabricated ties will not be acceptable. The portion of the tie remaining within concrete after removal of exterior parts should be 1 inch below the outer concrete surface, and the remaining hole in the concrete surface shall not be larger than 1-inch diameter, unless approved otherwise by the ENGINEER.

03100.2.2 JOINT FILLER

Shall be furnished and installed in accordance with Section 03310 herein.

03100.2.3 FORM RELEASE AGENTS

Commercial formulation form release agent compounds shall be used. Form release agents shall not bond with, stain or adversely affect concrete surfaces requiring later bond or adhesion. They shall not impede the wetting of surfaces to be cured with water or curing compounds. Surplus oil on forms and form oil on reinforcing steel and construction joints shall be removed before concrete is placed.

03100.2.4 FILLETS FOR CHAMFERED CORNERS

Shall be wood strips 3/4 inch by 3/4-inch size and of maximum possible length.

03100.2.5 MORTAR AND GROUT

Shall be furnished in accordance with Section 03600 herein.

03100.2.6 LIQUID CHEMICAL HARDENER

Shall be a colorless aqueous solution, containing a blend of magnesium fluosilicate, zinc fluosilicate and a wetting agent. The mixture shall contain not less than 2 pounds fluosilicate per gallon and shall not interfere with adhesives and the bonding of finishes where such is indicated.

03100.2.7 WATER

Water for curing shall meet the requirements of Section 03050 herein.

03100.2.8 MOISTURE RETAINING SHEETING

Shall be white, waterproof paper, polyethylene film or burlap-polyethylene sheet which meets the requirements of ASTM C-171.

03100.2.9 MOISTURE ABSORPTIVE COVER MAT

Shall be clean cotton or burlap fabric roll goods.

03100.2.10 CURING COMPOUND

Shall be a clear type with fugitive dye conforming to ASTM C-309, Type 1, unless otherwise approved by the ENGINEER. **CAUTION!!** The method of application of curing compound specified herein requires more product than is normally suggested by the manufacturer and that is customary in the trade. The amounts specified herein shall be applied, regardless of manufacturer's recommendation or customary practice.

03100.3 CONSTRUCTION REQUIREMENTS

03100.3.1 SITE CONDITIONS

The CONTRACTOR shall examine the condition of the area on which forms are to be installed and conditions under which the work of this Section is to be performed and shall correct unsatisfactory conditions which would prevent proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

03100.3.2 DESIGN OF FORM-WORK

03100.3.2.1 LOADING - Form-work shall be designed to safely support all vertical and lateral loads that may be induced by wet concrete both during the placement and afterward, until such loads can be supported by the structure itself as the concrete sets and begins to cure. Forms and falsework shall be designed to include assumed values of live load, dead load, weight of moving equipment to be operated on form-work, concrete mix, height of concrete drop, vibrator frequency, ambient temperatures, foundation pressures, stresses, lateral stability and other factors pertinent to the safety of the structure during construction.

In form-work design, provide for all openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screed, bulkheads, anchorage, inserts and other features as required on the Drawings.

03100.3.2.2 TOLERANCES – Form-work design shall call out material and components of sufficient strength, thickness, number of ties, amount of bracing, etc., to withstand the pressure of newly placed concrete without bow or deflection.

03100.3.3 FORM-WORK CONSTRUCTION

03100.3.3.1 COMPLIANCE – Form-work shall be constructed in compliance with ACI 347, to the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grade, and level and plumb work in finished structures.

03100.3.3.2 MATERIALS – Form-work shall be constructed from steel, steel reinforced panels, smooth grade plywood, or other materials which may be approved by the ENGINEER or shown on the Contract Documents for special purposes. Plywood material with raised grain, patches, or other defects that will mar the finished surface of the concrete surface shall not be used.

03100.3.3.3 ERECTION - Form facing materials shall be erected, supported, braced and maintained by structural members spaced to prevent deflection. Form-work shall be tight, to prevent leakage of cement paste during concrete placement. Joints shall be solidly butted together and backed up as required to prevent leakage and fins. Forms placed in successive units for continuous surfaces shall be fitted to provide accurate alignment, free from irregularities, and within allowable tolerances. Use selected materials to obtain required finishes.

Provide for all openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screed, bulkheads, anchorage, inserts and other features required. Accurately place and securely support items to be built into forms. Provide formed openings for elements to be embedded in or pass through the concrete. Install accessories in accordance with manufacturer's instructions and ensure items are not disturbed during concrete placement. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Bevel wood inserts for forming keyways, reglets, recesses and the like, to prevent swelling and assure ease of removal.

Form-work shall accommodate the work of all other trades where materials and products must be purchased and fabricated before the opportunity exists to verify the measurements of the adjacent construction affecting their installations. Verify size and location of all openings, recesses and chases with the trade requiring such items, and ensure that forms for openings and construction which accommodate installation by other trades, be accurately sized and located as dimensioned on the Drawings.

03100.3.3.4 FORM RELEASE AGENT - Coat form/concrete contact surfaces with form coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

03100.3.3.5 CLEANING - Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt and other debris just before concrete is placed.

03100.3.3.6 TOLERANCES – The ENGINEER recognizes that, given the realities of the physical world, there are times when formwork for concrete cannot be constructed closely enough to yield zero tolerances in the finished work. Therefore, the following tolerances are allowed but shall not be exceeded:

- In general, deviation in alignment of slabs and walls shall not exceed ¼ inch in the horizontal or vertical dimensions of a pour. All slabs which are indicated to be level shall have a maximum deviation of 1/8 inch in 10 feet without any apparent change in grade.

- The maximum tolerance from true level and plumb throughout the entire length and/or height of a structure shall be +/- ¼ inch and without any abrupt changes from one part of the pour to another.

- Form-work construction for circular structures shall be allowed a maximum deviation in the arc of ¼ inch in each 10 feet of radius; therefor, as an example, a tank with a 50 foot radius shall be allowed a maximum deviation of 1-1/4 inch from the center of the tank to the arc of the wall. In circular construction, the CONTRACTOR also is allowed to deviate from the finish line shown on the Drawings through the use of form panels, which will give chord lengths not to exceed 2 feet.

In the event that deviation from the Drawing dimensions results in problems in the field, the CONTRACTOR shall be responsible for resolution of the conditions, as approved by the ENGINEER, without additional expense to the OWNER.

03100.3.4 REMOVAL OF FORMS

03100.3.4.1 CONSIDERATIONS ASSOCIATED WITH FORM REMOVAL - Forms shall be removed in a manner to insure complete safety of the structure. Forms shall not be removed until concrete has sufficient strength to carry its own weight and the loads upon it with safety. Do not pry against face of concrete; use only wooden wedges.

03100.3.4.2 MINIMUM ELAPSED TIME - Forms shall not be removed sooner than the minimum elapsed times given in the following schedule unless allowed otherwise in the Contract Documents or as directed by the ENGINEER.

When directed by the ENGINEER, because of weather conditions or for other reasons, the forms shall remain in place for longer periods than stated below. The periods of time for form removal set forth below are minimums with no allowances for external loading. The periods of time set forth below are permissive only and do not relieve the CONTRACTOR from responsibility for risks associated with form removal.

MINIMUM ELAPSED TIME

Structural Component	Over 50°F	Between 40° and 50°F
Walls and perimeter forms at slab on grade panels	2 days	3 days

Underside of slabs	10 days	14 days
Side forms of beams	2 days	3 days
Underside of beams	10 days	14 days
Stairways	10 days	14 days

The time periods shown above are based on concrete materials being mixed and placed in accordance with these Specifications. When high early strength inducing admixtures are used in concrete, the ENGINEER may permit form removal after shorter times than those shown in the table. Form removal time also may be reduced if test cylinders of concrete, field cured along with the concrete they represent, have reached the strength specified in Paragraph 03050.2.6.2 of Section 03050 – Portland Cement Concrete.

03100.3.4.3 RE-SHORING - Where no re-shoring is planned, leave forms and shoring used to support weight of concrete in beams, slabs and other concrete members in place until concrete has attained its specified strength. Where re-shoring is planned, supporting form-work may be removed when concrete has reached 70 percent of specified strength, provided re-shoring is installed immediately.

Place re-shores as soon as practical after stripping operations are complete, but in no case later than the end of the working day on which stripping occurs. During re-shoring, do not subject concrete in beam, slab, column or any other structural member to combined dead, construction, and live loads in excess of loads permitted for developed concrete strength at time of re-shoring. Tighten re-shores to carry required loads without over stressing.

Re-shores shall remain in place until the supported concrete has reached its specified strength.

03100.3.5 CONCRETE FINISHING

03100.3.5.1 FINISHING FORMED SURFACES - Within 72 hours after forms are removed, the CONTRACTOR shall finish exposed surfaces in accordance with one of the procedures described below. Where no finish requirement is provided on the Drawings, formed concrete surfaces exposed to view and surfaces designated to receive paint shall be given a "Smooth" finish and slabs shall be given a "Trowel" finish. When workmanship is less than the acceptable standard, provide one of the rubbed finishes at no additional cost to OWNER.

- F1 - As Cast Form Finish - No finish.
- F2 - Rough Finish - Patch defects and chip or rub off fins exceeding 0.33 inch height.
- F3 - Smooth Finish - In addition to the rough finish requirements, patch tie holes and defects and remove fins completely. When surface texture is impaired and form joints misaligned, grind, bush-hammer or correct such areas. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete. Repair major mortar leakage as a defective area.
- F4 - Smooth Rubbed Finish - Remove forms and perform necessary patching as soon after placement as possible. Finish newly hardened concrete no later than 24 hours following form removal. Perform a smooth finish, then wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.
- F5 - Grout Cleaned Rubbed Finish - Undertake this operation after all contiguous surfaces are completed and accessible. Perform a smooth finish, then brush blast with abrasive basting to open surface pores. Wet surface of concrete sufficiently to prevent absorption of water from grout. Mix grout in accordance with Section 03600 and rub a uniform coat over surface to be finished. Immediately after grouting, scrub surface with cork float or stone to coat surface

and fill voids. While grout is still plastic, remove excess grout by working surface with rubber float or sack. After surface whitens from drying, rub vigorously with clean burlap. Keep damp for at least 36 hours after final rubbing.

- F6 - Cork Floated Rubbed Finish - Remove forms within 2 to 3 days of placement where possible. Perform a smooth finish and then dampen wall surface. Mix mortar in accordance with Section 03600, and apply with firm rubber float or with trowel, filling all surface voids and compress mortar into voids. If mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with fog sprayer. Produce a final texture with a cork float using a swirling motion.

- F7 - Unformed Finish - After concrete is placed, strike smooth, tops of walls or buttresses, horizontal offsets and similar unformed surface occurring adjacent to formed surfaces. Float to texture which is reasonably consistent with formed surface. Continue final treatment on formed surfaces uniformly across unformed surfaces.

- F8 - Blasted Finish - Complete a smooth finish then perform abrasive blasting within 24 to 72 hours after casting. Coordinate with form-work construction, concrete placement schedule and form-work removal to ensure that surfaces are blasted at the same age for uniform results. Reapply curing protection after blast finishing.

- F9 - Architectural Finish - Finish in accordance with ACI 303.

- F10 - Tooled Finish - Dress thoroughly cured concrete surface with electric, air or hand tools to uniform texture, and give a bush hammered surface texture. Remove sufficient mortar to exposed coarse aggregate in relief and to fracture coarse aggregate for tooled finish.

03100.3.5.2 REPAIRING FORMED CONCRETE SURFACES - When the Drawings indicate repairs are required or when the ENGINEER determines areas are defective and require repair, the following procedure shall be taken to make repairs:

- Remove defective concrete to sound concrete and make edges perpendicular to surface or slightly undercut. Feathered edges are not permitted.

- Dampen area to be patched and at least 6 inches surrounding it.

- Prepare bonding grout by mixing to consistency of thick cream and brush into surface.

- Tie holes shall be cleaned, thoroughly dampened, and filled solid with patching mortar.

- Make any patches in concrete to closely match color and texture of surrounding surfaces. Determine mix formula for patching mortar by trial to obtain a good color match with concrete when both patch and concrete are cured and dry.

- Mix white and gray Portland cement as required to match surrounding concrete to produce grout having consistency of thick paint. Use a minimum amount of mixing water.

- Mix patching mortar in advance and allow to stand, without addition of water, and without frequent manipulation, until it has reached a stiff consistency. After surface water has evaporated from patch area, brush bond coat into surface. When bond coat begins to lose water sheen, apply patching mortar. Thoroughly consolidate mortar into place and strike-off to leave patch slightly higher than surrounding surface. Leave undisturbed for at least 1 hour before final finish. Keep patched area damp for 72 hours or apply curing compound.

- Do not use metal tools in finishing an exposed patch.

- Where as cast finishes are indicated, total patched area may not exceed 1 in 500 as cast surface. This is in addition to form tie patches, if ties are permitted to fall within as cast areas.

- In any finishing process which is intended to expose aggregate on surface, patched areas must show aggregate. Outer 1-inch of patch shall contain same aggregates as surrounding concrete. After curing, expose aggregates together with aggregates of adjoining surfaces by same process.

03100.3.5.3 FINISHING SLAB SURFACES - In no case shall water be added to the surface (i.e., by sprinkling) to finish. Slab surfaces shall receive one of the following finish treatments as indicated on the Drawings:

- S1 - Floated Finish - After concrete has been placed, consolidated, struck-off and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared and surface has stiffness sufficient to permit operation. During or after first floating, check plainness of entire surface with a 10 foot long straight edge applied at 2 or more different angles. Cut down high spots and fill low spots to the required tolerance. Re-float slab immediately to a uniform sandy texture.

- S2 - Trowel Finish - Float finish the surface. Power trowel or hand trowel as required to provide a uniform surface. Do not apply (i.e. sprinkle) water or dry cement to surface of concrete when finishing. First troweling after floating shall produce smooth surface relatively free of defects but may still show some trowel marks. Second trowel by hand after surface has hardened. Leave finished surface essentially free of trowel marks, uniform in texture and appearance. On surfaces intended to support floor coverings, grind off defects which would show through floor coverings.

- S3 - Broom Finish – Trowel finish the surface. Power trowel or hand trowel as required to provide uniform surface. Lightly brush surface parallel to direction of drainage with a hair broom. Coarseness of broom bristle may be varied slightly, to achieve desired degree of surface roughness.

- S4 - Exposed Aggregate Finish - Immediately after surface of concrete has been leveled to tolerance and surface water has dissipated, spread aggregate uniformly over surface to provide complete coverage to the depth of a single stone. Embed aggregate into surface by light tamping. Float surface until embedded aggregate is fully coated with mortar and surface has been brought to tolerance. Start exposure of aggregate after matrix has hardened sufficiently to prevent dislodgement. Flow ample quantities of water, without force, over surface of concrete while matrix encasing aggregate is removed by brushing with a fine bristle brush. Continue until aggregate is uniformly exposed. An approved chemical retarder sprayed onto freshly floated surface may be used to extend working time.

- S5 - Chemical Hardener Finish - Apply liquid chemical hardener finish to interior concrete floors where indicated. Do not apply liquid chemical concrete hardener on floor areas scheduled to receive synthetic matrice terrazzo, setting beds for tile, terrazzo, vinyl flooring or like items. Apply hardener after complete curing and drying of concrete surface in accordance with manufacturer's recommendations. Evenly apply each coat and allow 24 hours for drying between coats. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

03100.3.6 CONCRETE CURING

03100.3.6.1 SURFACES WITH UNREMOVED FORMS - When forms are left in place (i.e., underside of beams, etc.) the CONTRACTOR shall proceed with curing adjacent surfaces without regard to the formed surfaces. When such forms are removed, curing shall then proceed over the entire surface.

03100.3.6.2 CURING CONDITIONS - Immediately after finishing of concrete surfaces (formed or slab) the CONTRACTOR shall verify concrete surfaces are ready for curing. The CONTRACTOR shall correct any conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected. A minimum ambient temperature of not less than 40° shall be maintained for at least 7 days during concrete curing. Concrete shall then be cured by one of the following methods:

- Moisture Cover - Water or continuous water-fog spray shall be applied, or the concrete surface shall be covered with water saturated absorptive mat kept continuously soaked, for not less than 7 days and nights.

- Moisture Retaining Sheet - Place cover in widest practicable width with sides and ends lapped and sealed to prevent moisture loss for a period of not less than 7 days and nights. All holes or tears in the cover sheet shall be kept repaired during the curing period.

- Membrane Curing Compound – All required repairs, patching, and final finishing operations shall be completed prior to application. Curing compound shall be applied as soon as the concrete is firm enough to work on. Slab surfaces shall be coated with curing compound within one hour after form removal; if more than one hour has elapsed, the surface shall be water cured.

  The compound shall be thoroughly mixed and a minimum of two coats shall be applied, with each coat applied in a direction different from that used for the preceding coat. The surface shall be coated and re-coated in a continuous operation until the surface has a uniform appearance; is effectively and completely sealed; and until a coating film remains on the surface of the concrete that can be scraped from the surface at any and all points after drying for at least 24 hours. Continuity of the coating shall be maintained, and all damage to the curing compound membrane shall be repaired, during the specified cure period.

  Curing compound shall not be allowed within the silhouette of any construction joint. If any curing compound enters the construction joint, the joint shall be sandblasted prior to placing any new concrete.

  Curing compound shall not be used on surfaces to be painted or coated.
  Surfaces intended to contain potable water (tank interiors, etc.) shall not be cured with curing compounds.

  Curing compound shall not be removed in less than 7 days from the time of application without written approval from the ENGINEER. When approved and prior to such removal, the CONTRACTOR shall provide a detailed plan for adequately curing the concrete.

03100.4 METHOD OF MEASUREMENT

Unless otherwise noted in the Special Provisions, separate measurement will not be made for concrete included as components of items shown in the Bid Schedule. Separate measurement for formed concrete and slabs shall be in accordance with the requirements of Section 03300.

03100.5 BASIS OF PAYMENT

Unless otherwise noted in the Special Provisions, no separate payment will be made for concrete included as components of items shown in the Bid Schedule. Separate payment for formed concrete and slabs shall be in accordance with the requirements of Section 03300.

03200.1 DESCRIPTION

Includes steel bars, wire fabric and rod mats required for cast-in-place concrete, with the necessary support chairs, bolsters, bar support and spacers required for supporting the reinforcement.

03200.1.1 RELATED Work

Section 03050 - Portland Cement Concrete
Section 03300 - Concrete Structures and Slabwork
Section 04810 - Unit Masonry Assemblies

03200.1.2 SUBMITTALS

03200.1.2.1 MILL TEST CERTIFICATION - Manufacturer's mill test certificates of supplied concrete reinforcement, indicating physical and chemical analysis shall be submitted.

03200.1.2.2 WELDER CERTIFICATION - Each welder's certification data shall be submitted to and approved by the ENGINEER prior to performance of welding on the project.

03200.1.2.3 SHOP DRAWINGS - Shop Drawings shall be submitted and shall indicate the sizes, spacings, locations and quantities of reinforcing steel and wire fabric; bending and cutting schedules; any proposed splicing; and reinforcement support, spacing devices and stirrup spacing.

03200.1.2.4 BAR SUPPORT SAMPLES - The CONTRACTOR shall submit for the ENGINEER's approval, samples of all bar supports it proposes to use along with a written description of where each type of bar support would be used.

03200.1.3 DEFINITIONS

Not used.

03200.2 MATERIALS

03200.2.1 CONCRETE REINFORCEMENT MATERIALS

03200.2.1.1 STEEL REINFORCEMENT - Unless otherwise specified, reinforcing steel shall be grade 60 billet steel conforming with ASTM A-615, including supplementary requirements S1. All such reinforcing shall be deformed steel bars with deformations in accordance with ASTM A-615. Bars shall be either uncoated or coated as indicated. ASTM A-706 steel shall be used if welding is indicated or allowed. All reinforcement shall be supplied in the maximum lengths practical or as indicated, unless otherwise authorized by the ENGINEER.

03200.2.1.2 WIRE FABRIC - Welded steel wire fabric shall be in accordance with ASTM A-1064 plain type. It shall be new stock and free of any rust when placed in the Work. Wire fabric may be supplied in flat sheets or coiled rolls and may be either coated or uncoated as indicated.

03200.2.1.3 STIRRUPS - Stirrup steel shall be in accordance with ASTM A-1064.

03200.2.1.4 SPIRAL REINFORCEMENT - Spiral reinforcement for columns or other components shall be cold drawn steel wire in accordance with ASTM A-1064.

03200.2.1.5 DOWEL BARS - Plain dowel bars for expansion joints shall be in accordance with ASTM A-615, 60-ksi-yield grade steel. Dowel bars shall be epoxy coated in roadway pavements. Metal dowel cans shall be provided at one end of dowel to permit longitudinal movement of the dowel within the concrete section. The CONTRACTOR shall provide for movement equal to the joint width plus 0.5-inch. Load transfer bars shall be painted with 1 coat of paint conforming to AASHTO M-254 and coated 1/2 with grease.

03200.2.2 ACCESSORY MATERIALS

03200.2.2.1 TIE WIRE - Tie wire shall be 16-gauge minimum cold drawn plain steel wire and shall be in accordance with ASTM A-1064.

03200.2.2.2 REINFORCEMENT SUPPORTS - Unless otherwise required in the Drawings or these Specifications, reinforcement supports bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place shall be wire type bar supports complying with CRSI recommendations. Wood, brick, and other unacceptable materials will not be allowed.

03200.2.2.3 SUPPORTS EXPOSED TO VIEW - Where support legs are in contact with forms on concrete surfaces exposed to view, supports shall be stainless steel or shall be provided with either hot-dip galvanized or plastic protected legs.

03200.2.3 FABRICATION

03200.2.3.1 STANDARDS - Steel reinforcement shall be cut, bent and fabricated in accordance with ACI SP-66 " ACI Detailing Manual" and with approved machine methods, in either the shop or the field.

03200.2.3.2 BENDING - Bars shall be accurately formed to the dimensions shown on the Drawings or applicable bending schedule. Bending or straightening in the shop or the field shall be accomplished so that the steel is not damaged. All bars shall be cold bent. Bends for hooks on bars shall be made around a pin having a diameter not less than 6 times the minimum thickness of the bar. Kinked bars shall not be used. Bars with bends not indicated on Drawings or final Shop Drawings shall not be placed in the Work. Reinforcement bars shall not be bent after they are embedded in concrete.

03200.2.3.3 SPLICES - Reinforcing splices not indicated on the Drawings shall be approved by the ENGINEER, and shall be located at points of minimum stress. The location of splices shall be indicated on Shop Drawings. Welding of reinforcing bars, when authorized by the ENGINEER, shall be performed in accordance with AWS D1.4. All rebar which is welded shall be grade 60 ASTM A706 material.

03200.3 CONSTRUCTION REQUIREMENTS

03200.3.1 DELIVERY AND STORAGE

03200.3.1.1 DELIVERY - Deliver reinforcement to the job site bundled, tagged and marked. Use metal tags indicating bar size, lengths and other information corresponding to markings shown on placement diagrams.

03200.3.1.2 STORAGE - Take all means necessary to protect reinforcement materials before, during and after installation and to protect the installed work of other trades. Store all reinforcement materials in a manner to prevent excessive rusting and fouling with grease, dirt and other bond breaking coatings. Take all necessary precautions to maintain identification after bundles are broken. In the event of damage or errors, immediately make all repairs or replacements necessary and at no additional cost to the OWNER.

03200.3.2 REINFORCEMENT ERECTION

03200.3.2.1 CLEAN AND SOUND MATERIALS - At the time of placement in the Work, reinforcement shall be free of loose mill scale, loose or excessive rust, paint, oil or grease, or other coating which may destroy its bond with the concrete. Bars with reduced cross-section due to rusting or other cause, even if all rust has been removed, shall not be allowed in the Work.

03200.3.2.2 CLEARANCE - Maintain the distance from vertical forms and between layers of reinforcement by means of prefabricated chairs, ties, hangers or other approved devices in accordance with "reinforcement support" paragraphs below. Placement and fastening of reinforcement in each section of the Work must be approved before concrete is placed.

03200.3.2.3 CLEAR DISTANCE - The clear distance between parallel bars shall not be less than one and one-half times the diameter of the bars and shall in no case be less than 1 inch nor less than the maximum size of the coarse aggregate specified.

03200.3.2.4 MINIMUM COVER - Unless otherwise shown on the Drawings or approved by the ENGINEER, for all formed surfaces, the minimum concrete cover over the steel reinforcement shall be 1 1/2 inches for bars number 5 and smaller and 2 inches for bars number 6 through 18. The largest specified cover shall be used when different sized bars are encountered in the same face. No "bury" or "carrier" bars will be allowed unless specifically approved by the ENGINEER.

03200.3.2.5 CUTOUTS AND OPENINGS - Where reinforcing steel has to be cut to permit passage of pipe or to create openings with no detail available on the Drawings for extra reinforcement in such areas, the area of steel removed by the creation of the opening must be replaced by placement of at least double the area of the steel removed equally around the openings created. The steel shall be placed such that it extends 5 feet beyond the opening on each side, to provide for sufficient bond.

03200.3.2.6 METAL MESH - Sheets of metal mesh shall be bent as shown or required on the Drawings to fit the work. It shall be rolled or otherwise straightened to make a perfectly flat sheet before placement in the Work. Supports for metal mesh shall meet requirements for reinforcing bar supports.

Sheets of metal mesh shall be spliced in accordance with ACI 318 and shall be overlapped no less than 12 inches or one square plus 6 inches, whichever is greater, to maintain a uniform strength. The mesh shall be securely fastened at the ends, edges and at all supports to maintain clearances and overlaps.

03200.3.2.7 NOTICE TO OTHER TRADES - The CONTRACTOR shall ensure that all other crafts, sub-contractors, engineering support groups, etc., whose work is related to concrete placement, are provided with ample notice and opportunity to introduce and finish required embedded items before concrete placement. All sleeves, inserts, anchors and any other embedded items shall be located and set in place prior to concrete placement. All voids in embedded items shall be temporarily filled to prevent entry of concrete.

03200.3.3 SPLICING

03200.3.3.1 ENGINEER APPROVAL - Except as shown on the Drawings, reinforcing steel shall not be spliced at any location without specific written approval of the ENGINEER. Splices in adjacent bars shall be staggered as directed by the ENGINEER.

03200.3.3.2 LAP SPLICES - Unless shown otherwise on the Drawings, or approved by the ENGINEER, bars up to and including number 11 shall be lap spliced in accordance with ACI 318 and shall be fastened together with steel wire.

Unless shown otherwise on the Drawings, or approved by the ENGINEER, bars at a lap splice shall be in contact with each other, and in no case shall the lap be less than 40 diameters of the spliced bars.

Unless shown otherwise on the Drawings, or approved by the ENGINEER, where bars are to be lap spliced at joints in the concrete, all bars shall project from the concrete first placed for a minimum length equal to the lap splice length as indicated on the Drawings. All concrete or other deleterious coating shall be removed from dowels and other projecting bars by wire brushing or sand blasting before the bars are embedded in a subsequent concrete placement.

03200.3.3.3 WELDING - Reinforcing steel shall be welded only if shown on the Drawings or approved in writing by the ENGINEER. All welding of reinforcing steel shall comply with AWS D1.4.

03200.3.3.4 EXPANSION JOINTS - Reinforcement, or other embedded metal items bonded to the concrete, shall not be permitted to extend continuously through any expansion joint, with the exception of dowels in floors bonded on only one side of joint.

03200.3.4 REINFORCMENT SUPPORT

03200.3.4.1 PLACEMENT - All reinforcement shall be supported and retained in place, true to indicated lines and grades, by the use of approved bar supports, sized to position the steel in the exact location required on the Drawings. Supports shall be spaced at intervals of not more than 5 feet on center in any direction, to prevent movement of the steel during concrete placement. Deck steel shall be tied down to beams or forms at regular intervals not exceeding 5 feet on center in any direction.

03200.3.4.2 CONCEALMENT - Supports shall be completely concealed in the concrete and shall not discolor or otherwise mar the surface of the concrete.

03200.3.4.3 SAND PLATES - Supports with sand plates or horizontal runners shall be used for slabs on grade where the base material will not support chair legs.

03200.3.5 QUALITY COMPLIANCE

Reinforcing materials found to be damaged or at variance with the requirements of the Drawings or these Specifications for size, quantity, strength, position, arrangement, or other attribute, shall result in rejection of the concrete Work if they are not brought into compliance.

03200.4 METHOD OF MEASUREMENT

03200.4.1 NO MEASUREMENT

Unless shown otherwise, concrete reinforcement shall be included with the concrete item within which it is installed and no separate measurement shall be made.

03200.4.2 SEPARATE MEASUREMENT

When shown as a separate item on the Bid Schedule, measurement of reinforcing steel will be, based on the theoretical or calculated number of pounds placed and accepted according to the requirements of the Drawings and these Specifications. Measurement shall exclude splice bars used to replace test samples. No deductions will be made for any bends except for hooks. The

length of the bar to be added to out-to-out dimensions of hooked bars will be shown on the plans. The weight calculations shall be based upon the following table:

WEIGHT CALCULATIONS FOR REINFORCING STEEL

Size	Lbs. per Lineal Foot	Size	Lbs. Per Lineal Foot
1/3 inch	0.167	#8	2.670
#3	0.376	#9	3.400
#4	0.668	#10	4.303
#5	1.043	#11	5.313
#6	1.502	#14	7.650
#7	2.044	#18	13.600

03200.5 BASIS OF PAYMENT

The accepted quantities of reinforcing steel will be paid for at the contract unit price. No allowance will be made for clips, wires or other material used for fastening reinforcement in place.

Payment will be made under:

PAY ITEM	UNIT
Reinforcing Steel	Pound

03300.1 DESCRIPTION

Covers concrete placement operations for cast-in-place structural building frames, slabs and other components.

03300.1.1 RELATED WORK

Section 03050 - Portland Cement Concrete
Section 03100 - Concrete Forming, Finishing and Curing
Section 03200 - Concrete Reinforcement
Section 03310 - Concrete Joints for Slabwork
Section 03600 - Grout and Mortar

03300.1.2 SUBMITTALS

03300.1.2.1 RECORD OF PLACED CONCRETE - CONTRACTOR's record of placed concrete, which indicate the date, time, temperature, location, quantity, names/types of any additives used, and type of curing materials or procedures used.

03300.1.2.2 DELIVERY TICKETS - Copies of delivery tickets which indicate the date and time of delivery; the producer and the truck number; the volume of delivery; and the amounts (weights) of cement, aggregates and any additives, including all water added at plant and in the field.

03300.1.3 DEFINITIONS

Not used.

03300.2 MATERIALS

03300.2.1 CONCRETE

Shall meet Class and material requirements of Section 03050.

03300.2.2 BONDING COMPOUND

Shall be polyvinyl acetate or acrylic base, single use type.

03300.2.3 VAPOR BARRIER

Shall be minimum 6 mil thick, polyethylene sheet, and the CONTRACTOR shall allow for 6 inch overlap at all edges, unless shown otherwise on Drawings. Vapor Barrier required for below grade application shall be free from pin holes, tears, scars and other defects.

03300.2.4 FORMS

Shall meet requirements of Section 03100.

03300.2.5 REINFORCEMENT

Shall meet requirements of Section 03200.

03300.2.6 COVERINGS AND CURING COMPOUND

Shall meet requirements of Section 03100.

03300.2.7 GROUT

Shall meet requirements of Section 03600.

03300.2.8 WATERSTOP

Waterstop shall be of the materials described and placed in the joints where shown on the Drawings and called for in these specifications. Precautions to insure proper support and location for the waterstop during concrete placement shall be taken.

03300.3 CONSTRUCTION REQUIREMENTS

03300.3.1 PREPARATION

03300.3.1.1 ENGINEER NOTIFICATION - The ENGINEER shall be given not less than 24 hours notice of a pour before it starts.

03300.3.1.2 REINFORCEMENT AND OTHER MATERIALS - All anchors, seats, plates, reinforcement and other items, to be embedded or cast into concrete, shall be accurately placed, held securely, and not impede concrete placement.

03300.3.1.3 CONSTRUCTION LOADS - The CONTRACTOR shall ensure that construction loads shall not exceed member capacity.

03300.3.1.4 PREVIOUSLY PLACED CONCRETE - The CONTRACTOR shall prepare previously placed concrete by bush hammering or cleaning with steel brush, as required by the Drawings or these Specifications, and by application of the required bonding compound in accordance with manufacturer's instructions.

03300.3.1.5 DOWELING TO EXISTING WORK - At locations where new work is to be doweled to existing work, the CONTRACTOR shall drill 1 inch minimum oversize holes 20 bar diameters deep into the existing concrete. Holes shall be thoroughly cleaned with oil free air filled with epoxy grout from the bottom out, then insert the dowel full depth.

03300.3.1.6 TEMPERATURES - Temperature at the time of placement shall meet requirements provided in Section 03050 and Subsection 03300.3.4.1 below.

03300.3.1.7 DELIVERY - The CONTRACTOR shall ensure that concrete delivery meets all requirements of Section 03050.

03300.3.2 CONCRETE PLACEMENT

Concrete shall be conveyed, deposited and consolidated by methods that preclude separation or loss of ingredients.

03300.3.2.1 CONVEYING OF CONCRETE – Conveying of concrete shall be carried out as follows:

- Chutes for conveying concrete shall be sloped to permit concrete of the required consistency to flow without segregation.
- Where necessary, chutes shall be supplied with baffle boards or a reversed section at the outlet.
- Concrete shall not be allowed to drop more than 6 vertical feet without the assistance of pipes or tremies.

03300.3.2.2 DEPOSITION OF CONCRETE – Deposition of concrete shall adhere to the following requirements:

- Concrete shall not be placed if the subgrade is muddy, soft, or frozen.
- Concrete shall be deposited as near to its final position as practical.
- Use of vibrators for shifting concrete is not permitted.
- Concrete shall be placed in horizontal layers insofar as practical with placement starting at the low point and proceeding upgrade.
- Concrete slabs or footings shall be placed on compacted soil surfaces and the subgrade shall have a dampened condition. To achieve the dampened condition, the subgrade may be sprinkled with water in advance of placing concrete.
- Concrete placement shall be continuous between construction joints and shall be terminated with square ends and level tops unless otherwise shown on the plans.
- Concrete shall not be placed in horizontal sections until the concrete in the adjoining vertical members has been consolidated and 2 hours has elapsed to allow for shrinkage.
- Where concrete is to be deposited against hardened concrete joints, placement shall not begin until a grout mixture has been coated on the joint. This grout mixture shall consist of mixture prescribed in Section 03600.

03300.3.2.3 CONSOLIDATION OF CONCRETE - Consolidation of concrete, except for slope paving and concrete placed underwater, shall be accomplished through the use of vibrators as follows:

- A sufficient number of spare vibrators shall be kept available to preclude interruption of concrete placement due to vibrator failure and to have the capacity to consolidate the concrete mass within 15 minutes after placement in the forms.
- The location, manner and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without separation of the mortar and coarse aggregate, and without causing water or cement paste to flow to the surface.
- Vibrators shall be operated so as not to contact the subgrade, reinforcing steel or form work, and shall not be used to move the mass of concrete horizontally.
- External vibration, except for vibrating screeds, shall not be used, unless approved by the ENGINEER prior to the start of concrete placement.

03300.3.3 WATERSTOPS

Waterstops in the walls shall be carried into the slabs below and shall join the waterstops in the slabs with factory-made fittings or welded joints. All joints in water-bearing structures shall have waterstops, whether indicated on the plans or not. For other location requirements for waterstops, see the general notes of the plans.

03300.3.4 TIME LIMITATIONS

Mixed concrete shall be rejected if it is not placed within 90 minutes after water is introduced into the mixture and air temperature is 80°F or less, or if it is not placed within 60 minutes after water is introduced into the mixture and air temperature is above 80°F; or if the initial set has developed.

03300.3.5 HOT OR COLD WEATHER PLACEMENT REQUIREMENTS

03300.3.5.1 TEMPERATURE LIMITATIONS - Concrete temperature shall be between 50°F and 90°F at the time of placement in the forms.

03300.3.5.2 HOT WEATHER CONDITIONS - Hot weather conditions shall be considered to exist when ambient temperatures exceed 90^0 F, or when the ambient temperature is below 90^0 F but the temperature to humidity relationships shown in the following table for conditions below 90^0 F exist.

TEMPERATURE/HUMIDITY RELATIONSHIP

Relative Humidity Less Than (Percent)	Air Temperature Greater Than (°F)	Maximum Concrete Temperature (°F)
80	90	90
70	90	90
60	90	90
50	90	85
40	90	80
30	80	75
20	75	70

During hot weather conditions, the CONTRACTOR shall take the following steps to protect the concrete:

- The concrete ingredients shall be cooled before mixing to maintain concrete temperature at time of placement below the maximum acceptable values listed in the table below.

  Mixing water may be chilled or chopped ice may be used to control the concrete temperature, provided the water equivalent of the ice is calculated into the total amount of mixing water. Ice shall be completely melted and dispersed throughout the mix at the completion of the mixing time.

  All methods and equipment for cooling of water and aggregate shall be subject to approval of the ENGINEER, and shall conform to ACI 305.1.

- Reinforcing steel shall be covered with water-soaked burlap as required, to prevent the steel temperature from exceeding the ambient air temperature immediately before concrete placement.

- Forms shall be thoroughly wet, but free of standing water, before concrete placement. Concrete should be placed in shallower layers than under normal weather conditions if necessary to assure coverage of the previous layer while it will respond readily to vibration.

- Fog spray shall be used during finishing whenever necessary to avoid surface plastic-shrinkage cracking. Fog spray shall also be used after finishing, before the specified curing is commenced, to avoid surface plastic-shrinkage cracking.

- Forms shall be kept covered and continuously moist. Once forms are loosened and during form removal, concrete surfaces shall be protected from drying, and shall be kept continuously wet by fog spraying or other approved means.

Additional costs due to concrete placement in hot weather conditions shall be the responsibility of the CONTRACTOR.

03300.3.5.3 COLD WEATHER CONDITIONS - Cold weather limitations shall apply when air temperature falls below 40°F. Procedures for protecting concrete shall be in accordance with ACI Standard 306.1, "Standard Specifications for Cold Weather Concreting." If concrete placement is necessary during low temperature conditions, the CONTRACTOR shall take the following steps to protect the concrete:

- The CONTRACTOR shall heat all water and aggregates uniformly in accordance with Section 03050 before mixing, to obtain a concrete mixture temperature between 60°F and 90°F at the time of placement.

- The CONTRACTOR shall not use calcium chloride, salt or other material containing antifreeze agents or chemical accelerators unless approved otherwise in writing by the ENGINEER.

- If temperatures are expected to drop below 32°F the night before the concrete is placed, all reinforcement, the forms, and the ground shall be blanketed. If the temperature falls below 20°F, the area shall be preheated at a minimum temperature of 40°F for a minimum of 12 hours prior to placement.

- The concrete shall be protected from freezing. The CONTRACTOR shall furnish all materials and equipment to insulate and to heat the work as necessary to maintain concrete temperatures above 50°F.

- Concrete temperature shall be maintained at not less than 50°F and not more than 70°F for the first 7 days after placement.

- Combustion type heaters, which produce carbon monoxide (CO), shall be adequately vented.

The CONTRACTOR shall assume all risk in connection with placing concrete in cold weather conditions. Permission given to place concrete in cold weather shall in no way relieve the CONTRACTOR of the responsibility for compliance with these Specifications. Any work not in compliance with these Specifications due to cold weather conditions shall be removed and replaced at the CONTRACTOR's expense.

03300.3.6 JOINTS

03300.3.6.1 COMPLIANCE - Construction joints shall be placed at the locations shown on the Drawings or as approved by the ENGINEER. Expansion and contraction joints and joint sealing shall be accomplished in accordance with Section 03310.

03300.3.6.2 CLEANING - Unless otherwise directed by the ENGINEER, all construction joints shall be cleaned prior to placement of concrete. All unsatisfactory concrete, latency material, stains, debris, and other foreign materials shall be removed. After cleaning, the surface shall be washed thoroughly to remove all loose material. Excess water shall be disposed of in such manner that it will not stain, discolor, or otherwise affect adjacent surfaces of the structures.

03300.3.7 FINISHING

Finishing shall be accomplished as indicated on the Drawings and in accordance with the requirements of Section 03100. Water shall not be sprinkled on concrete surfaces during finishing.

03300.3.8 CURING

Curing shall meet the requirements of Section 03100.

03300.3.9 PROTECTION

The CONTRACTOR shall provide necessary barriers, walkways, etc. to protect freshly placed concrete from physical damage. Any damage sustained as a result of failure to provide such protection shall be corrected at the CONTRACTOR's expense.

03300.3.10 REPAIR OF DEFECTIVE CONCRETE

03300.3.10.1 REPAIR FOR NON-COMPLIANCE - All concrete that fails to conform to required material characteristics, dimensions, lines, finishes and elevations shown on the Drawings, or in accordance with these Specifications shall be replaced or corrected in accordance with these Specifications and as approved by the ENGINEER.

03300.3.10.2 ADDITIONAL TESTING - Any engineering analysis and additional testing required to determine the extent of repair will be provided by the CONTRACTOR at no additional cost to the OWNER.

03300.3.10.3 REMOVAL OF SLABS WITH CRACKS - Removal of concrete sections with cracks in slabs which occur within 2 feet of expansion or construction joints may be deemed necessary by the ENGINEER.

03300.3.11 QUALITY COMPLIANCE

Concrete work may be rejected for failure to comply with the following requirements:

03300.3.11.1 SPECIFICATION NON-COMPLIANCE - Concrete work shall be rejected if the materials used in the work fail to comply with the requirements of Section 03050 and 03200.

03300.3.11.2 STRENGTH TEST FAILURE - Concrete work, for which the average of three 28-day compressive or flexural strength samples made from the same batch falls below the acceptance level, per ACI 301 and 318, shall be rejected, unless otherwise directed by the ENGINEER.

03300.3.11.3 IMPROPER CURING - Concrete work for which the method of curing is not as specified, or that has been inadequately protected from extremes of temperature during the early stages of hardening and strength development, shall be rejected, unless otherwise directed by the ENGINEER.

03300.3.11.4 ACCIDENT AND INJURY - Concrete work that has been subjected to construction fires, accidents, mechanical injury or premature removal of formwork likely to result in deficient strength development, shall be rejected, unless otherwise directed by the ENGINEER.

03300.3.11.5 POOR WORKMANSHIP - Concrete work, subjected to poor workmanship that may result in deficient strength or load carrying capacity, including but not limited to honey combing, cold joints, introduction of contaminants or embedded debris, improper placement location or dimensions, etc., shall be rejected, unless otherwise directed by the ENGINEER.

03300.3.11.6 POOR FINISH - Concrete work that fails to meet the required finish in accordance with the requirements of Section 03100, or exposed concrete with defects adversely affecting the appearance of the specified finish shall be rejected, unless otherwise directed by the ENGINEER.

03300.4 METHOD OF MEASUREMENT

03300.4.1 NO MEASUREMENT

When concrete is not indicated as a separate item in the Bid Schedule, no measurement will be made and the concrete required for a structure shall be considered a component of another item or items shown in the Bid Schedule.

03300.4.2 SEPARATE MEASUREMENT

03300.4.2.1 CUBIC YARD - When concrete is indicated as a separate item on the Bid Schedule, measurement shall be made by counting the number of cubic yards placed and accepted as determined by calculating volumes using the dimensions shown on the Drawings. This measurement shall NOT include:

- Any allowance for reinforcing steel in concrete.
- Any allowance for concrete required for filling over-excavation for footings, walls or slabs.
- Any allowance for volume occupied by pipes (except culverts), reinforcing steel, anchors, conduits, or weep holes.

03300.4.2.2 SQUARE UNIT – Measurement for square feet or yards of concrete shall be made using an accurate measuring device to determine the length and breadth of concrete placed and accepted and then multiplying those values to find the amount of area covered.

03300.5 BASIS OF PAYMENT

The accepted quantities shall be paid for at the contract unit price:

PAY ITEM	UNIT
Concrete (*Class* _____)	Cubic Yard
Concrete (*Class* _____)	Square Yard
Concrete (*Class* _____)	Square Foot
Concrete Structure (*Name*)	Lump Sum

03310.1 DESCRIPTION

Furnish materials and install appropriate longitudinal and transverse expansion joints, construction joints and crack control joints in slabs and pavement.

03310.1.1 RELATED WORK

Section 03050 - Portland Cement Concrete
Section 03100 - Concrete Forming, Finishing, and Curing
Section 03300 - Concrete Structures and Slabwork

03310.1.2 SUBMITTALS

The CONTRACTOR shall submit the following to the ENGINEER for review and approval:

03310.1.2.1 PRODUCT CERTIFICATION – The manufacturer's certification that product was manufactured, tested and supplied in accordance with source control requirements specified herein, together with a report of the test results and the date each test was completed.

03310.1.2.2 INSTRUCTIONS – The manufacturer's instructions for joint preparation, type of cleaning and installation.

03310.1.2.3 DATA SHEETS – The manufacturer's product and safety data for each joint sealant product required.

03310.1.2.4 SAMPLES – A manufacturer’s sample of each joint sealant product required.

03310.1.3 DEFINITIONS

Not used.

03310.2 MATERIALS

03310.2.1 GENERAL

03310.2.1.1 COMPATIBILITY OF MATERIALS - Provide joint filler, sealant backings, sealants and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

03310.2.1.2 DELIVERY OF MATERIALS - Deliver materials to site in original unopened containers or bundles with labels identifying manufacturer, product name and designation, color, expiration period for use, pot life, cure time and mixing instructions for multi-component materials.

03310.2.1.3 STORAGE AND HANDLING OF MATERIALS - Store and handle materials in compliance with manufacturer's recommendations to prevent deterioration; or damage due to moisture, high or low temperatures, contaminants or other causes.

03310.2.2 PRODUCTS

03310.2.2.1 JOINT VOID FORMER - Shall be of plastic with a waterstop and shall extend 1/3 of the depth of the concrete structural section.

03310.2.2.2 JOINT FILLER - J4 joint filler shall be the required standard and shall be used unless another filler from the list below is specified. Fillers shall be non-extruding, resilient, and meet the requirements of ASTM D-545:

- F1 Joint Filler – 13mm thick filler for expansion joints; bituminous (asphalt or tar) mastic in accordance with ASTM D-994; formed and encased between 3 layers of bituminous saturated felt or 2 layers of glass fiber felt.
- F2 Joint Filler - Cane or other cellulosic fiber in accordance with ASTM D-1751, saturated with asphalt.
- F3 Joint Filler - Granulated cork in accordance with ASTM D-1751; in an asphalt binder; encased between 2 layers of asphalt saturated felt or 2 layers of glass fiber felt.
- F4 Joint Filler - Sponge rubber fully compressible in accordance with ASTM C-1752, with resiliency recovery rate of 90 percent minimum.
- F5 Joint Filler - Cork in accordance with ASTM C-1752; impregnated and bound with asphalt; compressible with resiliency recovery rate of 90 percent if not compressed more than 50 percent of original thickness.
- F6 Joint Filler - Plastic foam (for cold-applied sealants only) pre-formed, compressible, resilient, non-waxing, non-extruding strips of flexible, non-gassing plastic foam; non-absorbent to water and gas; 20 lb/ft^3 density maximum; and of size and shape to control sealant depth and performance.
- Synthetic Sponge Rubber Filler - Synthetic sponge rubber filler shall be an expanded closed cell sponge rubber, manufactured from a synthetic polymer neoprene base. The material shall be No. 750.3 Ropax Rod Stock as manufactured by the Presstite Division of Interchemical Corporation; Bondtex as manufactured by Rubatex Corporation; or approved equal. The size of the material shall be 25 percent greater in diameter than the nominal joint width. The manufacturer's instructions for surface preparation and application shall be used as a guide for installation, except that the material shall not be installed by stretching beyond its normal length.

03310.2.2.3 SEALANT - Hot applied joint sealant shall be one of the following:

- HAS1 Sealant - Resilient and adhesive compound type in accordance with ASTM D-3405, for Portland cement concrete or asphalt concrete pavements.
- HAS2 Sealant - Thermoplastic type in accordance with ASTM D-3581, jet fuel resistant without rubber, unless indicated otherwise.
- HAS3 Sealant - Elastomeric type in accordance with ASTM D-1190.
- HAS4 Sealant - Elastomeric type in accordance with ASTM D-3406, one component, for Portland cement concrete pavements.
- HAS5 Sealant - Elastomeric type in accordance with ASTM D-3569, one component, jet-fuel resistant, for Portland cement concrete pavements.

Cold applied joint sealant shall be one of the following:

- CAS1 Sealant - Elastomeric type in accordance with ASTM C-920; chemically curing, for vehicular or pedestrian use and types of construction other than highway and airfield pavements and bridges and joint substrates indicated; Type S or M; Grade P or NS; Class 25; Use T, NT, M and O with the following characteristics:

  ⇒ Self leveling
  ⇒ 40 ± 5 ASTM D-2240 Shore A Hardness
  ⇒ 4 days minimum final cure
  ⇒ 10 to $+150^0$ F service range

- CAS2 Sealant - Mastic type in accordance with ASTM D-1850, single or multiple companion, for joints having a minimum width of 1/2 inch.

- CAS3 Sealant - Coal tar modified urethane type in accordance with FS SS-S-200; one part, jet fuel resistant; Type H.

- CAS4 Sealant – Elastomeric, pre-formed polychloroprene type with lubricant adhesive and indicated movement ratio which meets one of the following:

  ⇒ For concrete pavement seal; ASTM D-2628
  ⇒ For concrete bridge seal; ASTM D-3542

Synthetic rubber sealant shall be as follows:

- The sealant shall be a 3-part polyurethane compound.

- Sealant shall be designed to cure at room temperature to a firm, highly resilient rubber.

- Sealant shall have the following properties determined at conditions of 75° F and 50 percent relative humidity:

  ⇒ Base - polyurethane rubber
  ⇒ Solids - not less than 97 percent
  ⇒ Application time - not less than 3 hours
  ⇒ Cure time - not more than 5 days
  ⇒ Ultimate hardness - 35 ± 5 (Shore A Durometer)
  ⇒ Tensile strength (ASTM D412) - 300 pounds per square inch minimum
  ⇒ Ultimate elongation - not less than 300 percent
  ⇒ Color - gray to match concrete unless otherwise indicated

- All packages shall be code dated. No material shall be more than 6 months old when used. Material shall have been kept at temperatures lower than 80° F at all times.

03310.2.2.4 BACKER ROD – Backer rod shall be neoprene, butyl, EPDM, or silicone tubing complying with ASTM D-1056, water and gasoline non-absorbent, capable of remaining resilient at temperatures down to -26°F. Provide product with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

03310.2.2.5 BOND BREAKER TAPE – Bond breaker tape shall be self-adhesive polyethylene or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to joint filler materials or joint surfaces at back or bottom of joint.

03310.2.2.6 WATERSTOPS - Waterstop shall be rubber waterstop or PVC waterstop as designated on the Plans or in the Special Provisions and shall meet the requirements described herein.

- Waterstops shall be as manufactured by Burke Concrete Accessories Inc., Kirkhill Rubber Company, Williams Products Inc., Greenstreak, or approved equal:

- Waterstop shall be of the width and cross-section configuration shown on the Drawings or required in the Special Provisions.

- At expansion joints, only hollow centerbulb type waterstop shall be used.

Rubber waterstop shall meet the following requirements and conditions:

- Waterstop shall be manufactured to ensure an integral cross section which will be dense, homogeneous, and free from porosity and other imperfections.

- Minor surface defects, such as surface peel, covering less than 1 square inch and surface cavities or bumps less than ¼" in longest lateral dimension and less than 1/16" deep, will be acceptable.

- The rubber waterstop shall meet the following Specifications:

  ⇒ Hardness-Shore A Durometer – 60 to 70, ASTM D 2240
  ⇒ Elongation - not less than 450%
  ⇒ Tensile Strength - not less than 3,000 psi
  ⇒ Tensile Strength after aging 48 hours in oxygen at 70°C and 300 psi - not less than 80% of original
  ⇒ 300% Modulus - not less than 900 psi
  ⇒ Water absorption after 2 days at 158°F – not more than 5%
  ⇒ Compression set after 22 hours at 158°F - not more than 30%
  ⇒ Specific Gravity - 1.17 ± .03

Polyvinylchloride (PVC) waterstop shall be as manufactured by Greenstreak, or approved equal, and shall meet the following requirements and standards:

	Property	ASTM Test	Nominal Value
⇒	Water absorption	D 570	0.15
⇒	Tear resistance	D 624	350/lb.in.
⇒	Ultimate elongation	D 638	390%
⇒	Tensile strength	D 638	2250 psi min.
⇒	Low temperature brittleness	D 746	$+35^0$F/$+37^0$C (passed at)
⇒	Stiffness in flexure	D 747	1190 psi
⇒	Specific gravity	D 792	1.37
⇒	Ozone resistance	D 1149	No failure
⇒	Volatile loss	D 1203	0.30%
⇒	Hardness (Shore A15)	D 2240	76+/3
⇒	Accelerated Extraction		
	Tensile strength		2130 psi
	Elongation		370%

PVC waterstop shall be heat weldable, have great inherent elasticity, be impervious to many waterborne chemicals, be suitable for above or below grade installation, not produce electrolytic reactions, and not discolor concrete or mortar.

See Subsection 03310.3.4 for waterstop installation specifications.

03310.3 CONSTRUCTION REQUIREMENTS

03310.3.1 WEATHER CONDITIONS

Do not proceed with installation of joint sealant under unfavorable weather conditions. Install elastomeric sealant only when temperature is stable within the temperature range recommended by manufacturer for installation.

03310.3.2 PREPARATION

03310.3.2.1 JOINT CLEANING - Clean, prepare and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter. Do not proceed with installation of joint sealant until contaminants capable of interfering with sealant adhesive properties are removed from joint substrates. Remove any moisture on the substrate.

Remove protective coating and any oil from metals with solvent recommended by the sealant manufacturer.

03310.3.2.2 JOINT DIMENSIONS - Examine joint dimensions and size materials to achieve required width to depth ratio. Adjust joint depths to allow sealant to perform properly.

03310.3.2.3 MATERIAL COMPATIBILITY - Verify that joint shaping materials and release tapes are compatible with sealant.

03310.3.3 CONSTRUCTION

03310.3.3.1 FEATURES AND PURPOSES OF JOINT CONSTRUCTION - Construct all joints as follows:

- At right angles to top surface of placement.
- Straight unless indicated otherwise.
- Before uncontrolled shrinkage cracking takes place.
- To prevent concrete edge slump.

03310.3.3.2 BOND BREAKER TAPE - Install where needed or required by manufacturer's recommendations to ensure that elastomeric sealant will perform properly.

03310.3.3.3 EXPANSION JOINTS - Expansion joints shall be constructed as follows:

- They shall be placed in locations as shown on the Drawings or as approved by the ENGINEER.
- Joints in exterior concrete slab work shall be placed where shown on Drawings or as recommended by Portland Cement Association's "Design and Control of Concrete Mixture Manual".

- Pre-molded filler strips shall extend full depth in slab.

- Unless otherwise noted on the Drawings or directed by the ENGINEER, isolation joints shall be used in all areas where slabs abut vertical surfaces. Joint material shall be placed as called for and in good alignment.

- In no case shall the reinforcing or other fixed metal items embedded in or bonded to concrete be made to run continuously through an expansion joint.

- Concrete edges at joints shall be neatly finished with an edging tool providing a slightly rounded edge on each side of the joint filler material.

03310.3.3.4 CONSTRUCTION JOINTS - Other references to construction joints are located in Subsection 03300.3.6.

03310.3.3.5 CONTROL JOINTS – Control joints shall be constructed as follows:

- Tooled Joints. Tooled joints shall be formed by scoring the slab full depth with a steel trowel along a straight edge in locations as shown on the Drawings or, if not shown, not to exceed 625 square feet in area. The joint shall be finished using a joint tool guided by a straight edge leaving a slightly rounded edge on each side of the joint.

- Sawn Joints. Sawn joints shall be sawn into interior concrete floors as indicated on the Drawings and at CONTRACTOR's option in place of pre-formed metal keys. Joints shall be sawn with a power saw designed to saw depth and width as shown on Drawings. Hand held saws will not be accepted. Saw cutting shall occur within 12 hours after placement of concrete. The line of the saw shall be straight, true to line and square. Pourable joint sealant shall be poured into all sawn joints. Installation shall be in strict accordance with manufacturer's specifications which shall include preparation, priming, etc.

03310.3.3.6 JOINT SEALING - Installation of joint sealant shall adhere to the following procedures:

- Manufacturer's Instructions. Application shall be in strict accordance with the manufacturer's published instructions.

- Surface Preparation. All surfaces to which synthetic rubber sealant must bond shall be dry and free of dust, dirt, and other foreign residue and shall be primed with the manufacturer's recommended primer for the particular surface. Remove all oil, grease, wax, form release agents, curing compounds, bitumen, old caulking, and other latent material by sand blast or water blast, as recommended by the sealant manufacturer. Maximum angle for sand blasting is 25 degrees $\pm$ 5. Clean and dry with air blast. Do not contaminate air blast with oils or lubricants. Remove frost and moisture in concrete joint substrates before commencing sealing.

- Installation. If necessary, joints shall be saw cut, to provide the required sealant thickness and depth. Application shall be by means of a pneumatic caulking tool or other approved method. Ensure that sealant is installed in uniform, continuous ribbons without gaps or air pockets, with complete bonding of joint surfaces on opposite sides. Except as otherwise indicated, fill sealant rabbet flush with surface. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove so that joint will not trap moisture and dirt.

Install sealant to depths indicated or, if not indicated, as recommended by sealant manufacturer, but within the following general limitations measured at center (thin) section of bead:

⇒ For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but neither more than 5/8 inch deep nor less than 3/8 inch deep.

⇒ For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2 inch deep nor less than 1/3 inch deep.

⇒ For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75 percent to 125 percent of joint width.

- Overflow and Spillage. Do not allow poured sealant compound to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces. Clean adjoining surfaces to eliminate evidence of spillage.

- Overheating. Do not overheat hot applied sealants.

- Exposed Edges. Unless indicated otherwise, recess exposed edges of gasket and exposed joint filler slightly behind adjoining surface so compressed units will not protrude from joints.

03310.3.3.7 CURING AND PROTECTION – The CONTRACTOR shall follow the steps listed below regarding curing and protection of sealant:

- Cure sealant and caulking compounds in accordance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.

- Follow procedures required for cure and protection of joint sealants during construction period so they will be without deterioration or damage (other than normal wear and weathering) at time of Substantial Completion.

- Protect joint sealant during and after curing period from contact with contaminating substances, or from damage resulting from deterioration through the time of Substantial Completion.

- If damage or deterioration occurs, immediately cut out and remove damaged or deteriorated joint sealant and reseal joint with new materials. Repaired area shall be indistinguishable from un-repaired area.

03310.3.3.8 CLEANUP - Clean off all excess sealant or sealant smears adjacent to joints as the work progresses. Use methods and cleaning materials approved by manufacturers of joint sealant and of the products in which joints occur.

03310.3.4 WATERSTOPS

03310.3.4.1 INSTALLATION - Waterstops shall be installed in concrete joints where and as indicated on the Plans. Waterstops shall be set accurately to the position and line indicated on the Plans. Where required at expansion joints, the hollow, centerbulb type waterstop shall be installed centered on the joint.

03310.3.4.2 CONTINUITY - All waterstops shall be continuous. Waterstops in walls shall be carried into lower slabs and shall join the waterstops in the slabs with appropriate types of fittings. Waterstops shall be terminated 3 inches from the top of finished surfaces of walls and edges of slabs unless otherwise specified or indicated on the Plans.

03310.3.4.3 FASTENING IN PLACE - Edges shall be held and securely fixed in position at intervals of not more than 24 inches to prevent movement during the placing of the concrete. Wires placed near the outer bulb and/or special clips may be used for this purpose, at the CONTRACTOR's option. No nails shall be driven through a waterstop in the vicinity of any construction joint.

03310.3.4.4 JOINTS – Waterstop joints shall meet the following requirements

- All waterstop joints shall be watertight.
- All joints shall be made by the use of factory-made fittings and unions, some of which will be special.
- Fittings and unions shall be cemented in place using clamps over the entire area of splice until the cement is bonded permanently.
- Welding of the waterstop without the use of factory-made unions and fittings will not be permitted.
- Split type waterstop may be used, at the option of the CONTRACTOR, provided that all junctions between standard solid type waterstop and split type waterstop shall be made with solidly welded and cemented unions between the two waterstops. This union may be split and re-cemented in accordance with the manufacturer's recommended method.
- Cement shall be as recommended by the manufacturer of the waterstop, and field cementing or solvent welding shall be in accordance with the manufacturer's directions.

03310.4 METHOD OF MEASUREMENT

Unless otherwise indicated in these Specifications, no separate measurement will be made for the materials and work covered by this section.

03310.5 BASIS OF PAYMENT

Unless otherwise noted in these Specifications, no separate payment will be made for items under this section. Compensation shall be included in the prices paid for the various contract items and no separate compensation will be allowed.

03500.1 DESCRIPTION

This is a generic specification covering furnishing and installing of pre-cast concrete units, complete with required accessories as shown on the Drawings and called out in these Specifications.

03500.1.1 RELATED WORK

Section 01300 - Submittals
Section 02224 - Sewer Pipe and Manholes
Section 03050 - Portland Cement Concrete

03500.1.2 SUBMITTALS

03500.1.2.1 SHOP DRAWINGS - Submit shop drawings showing unit design, signed and sealed by a Professional ENGINEER, in accordance with Section 01300. The CONTRACTOR shall not proceed with fabrication until shop drawings have been approved.

03500.1.2.2 UNIT DESIGN – Unit design shall incorporate the following:

- Pre-cast units shall be designed in accordance with ACI 318 and PCA design handbooks under the direction of a Professional ENGINEER experienced in the design of such units.
- Indicate unit locations, unit identification marks, fabrication details, reinforcement, connection details, pertinent dimensions, and erection support points.
- Units shall be designed to support the required shipping and handling loads, and the live, dead and construction loads.
- Component connections shall be designed to provide adjustment to accommodate misalignment of structure during installation.
- The ENGINEER may approve design deviations provided that equivalent units serving the same basic function and intent are furnished at no additional cost to the OWNER. Such deviations shall only be approved upon written request and when accompanied with complete design calculations and drawings.

03500.1.3 DEFINITIONS

Not used.

03500.2 MATERIALS

03500.2.1 ACCESSORIES

Connecting and supporting devices shall be carbon steel in accordance with ASTM A 36. Bolts, nuts and washers shall be carbon steel or stainless steel as required on the Drawings. Grade 60 reinforcement shall be provided for all units.

03500.2.2 IDENTIFICATION MARKS

Unit identification marks shall appear on all manufactured units.

03500.2.3 FINISHES

Shall be in accordance with one of the following paragraphs. If no finish is prescribed on the Drawings, the Standard Finish will be provided.

03500.2.3.1 STANDARD FINISH - Produced in plastic or metal lined forms which impart a smooth finish. Small surface holes, normal form joint marks, minor chips and spalls may be approved. Major or unsightly imperfections, honeycomb or structural defects are not acceptable.

03500.2.3.2 COMMERCIAL FINISH - Produced in plastic or metal lined forms which impart a smooth finish. Remove fins and large projections and fill holes over 1/2 inch with sand-cement paste. Faces shall be true and well defined. Exposed ragged edges shall be corrected by rubbing or grinding.

03500.2.3.3 ARCHITECTURAL GRADE FINISH - Produced in plastic or metal lined forms which impart a smooth finish. Fill holes over 1/4 inch in diameter with sand-cement paste. Grind smooth form offsets or fins over 1/8 inch. Coat with neat cement paste using a float and after paste has dried, rub with burlap to remove loose particles.

03500.2.3.4 SPECIAL FINISHES - Finishes produced by sandblasting, acid washing, or form liners shall be specifically defined on the Drawings or in these Specifications and samples showing texture and color will be required for approval.

03500.2.3.5 PAINTABLE FINISHES - Where unit surfaces will be painted, only form release agents compatible with paints shall be used during fabrication.

03500.3 CONSTRUCTION REQUIREMENTS

03500.3.1 FABRICATION

Fabrication of pre-cast units shall proceed as follows:

03500.3.1.1 RECORDS - Maintain plant records and quality control program during production of structural pre-cast concrete. Make records available to ENGINEER.

03500.3.1.2 MOLDS - Use molds which are rigid and constructed of material that will result in uniform finished products.

03500.3.1.3 PLACEMENT AND VIBRATION - Place and vibrate concrete to ensure: proper consolidation, elimination of cold joints, and minimize entrapped air marks on finished surfaces.

03500.3.1.4 REINFORCEMENT AND FITTINGS - Provide required connecting devices, plates, angles, and connectors to steel framing members, bolts and accessories. Ensure reinforcing steel, anchors, inserts, plates, angles and other cast-in items are sufficiently embedded, anchored and properly located.

03500.3.1.5 LIFTING DEVICES - Embedded lifting or handling devices shall be capable of supporting units in positions anticipated during manufacture, storage, transportation and erection.

03500.3.1.6 FINISHED SURFACE - Ensure finished surfaces of pre-cast structural units are uniform.

03500.3.1.7 CURING - Cure units under identical conditions to develop specified concrete quality and minimize appearance of blemishes such as non-uniformity, staining or surface cracking.

03500.3.2 DELIVERY, STORAGE AND HANDLING

03500.3.2.1 DELIVERY - Unless otherwise approved in writing, do not deliver units to job site until required for installation.

03500.3.2.2 EDGE PROTECTION - Provide edges of units with adequate protection to prevent staining, chipping or spalling of concrete.

03500.3.2.3 HANDLING - Handle pre-cast units in positions consistent with their shape and design. Lift and support only from support points indicated on Shop Drawings.

03500.3.2.4 BLOCKING AND BRACING - Block and laterally brace units while in storage. Provide lateral bracing that is sufficient to prevent bowing and warping. Bracing shall be clean, non-staining and of a type that will not inhibit uniform curing of exposed surfaces.

03500.3.3 INSTALLATION

Do not install pre-cast units until concrete has attained its design compression strength. Install members plumb, level and in alignment. Clean weld marks or other marks, debris or dirt from exposed surfaces of units.

03500.3.4 REPAIR

Repair of damaged units may be acceptable if structural integrity or appearance is not impaired.

03500.4 METHOD OF MEASUREMENT

03500.4.1 NO MEASUREMENT

Separate measurement for pre-cast concrete units will not be made when the unit is a component of a building, assembly or enclosure for which identification is made in the Bid Schedule.

03500.4.2 SEPARATE MEASUREMENT

When pre-cast concrete units appear as a separate item on the Bid Schedule, they will be measured either by counting the number of units installed and accepted or by using a measuring tape or other accurate measuring device to determine the total number of lineal feet of units installed and accepted.

03500.5 BASIS OF PAYMENT

Separate payment for pre-cast concrete units will not be made when they are a component of building, assembly or enclosure identified in the Bid Schedule.
The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
Pre-Cast Concrete (*Describe*)	Each
Pre-Cast Concrete (*Describe*)	Lineal Foot

03600.1 DESCRIPTION

This section covers furnishing materials and placing Portland cement grout, epoxy grout, and mortar for finishing concrete surfaces, leveling beds for structural steel plates, sealing joints between piping and structures, and sealing joints between construction components.

03600.1.1 RELATED WORK

Section 03100 - Concrete Forming Finishing, and Curing
Section 03300 - Concrete Structures and Slabwork
Section 04100 - Brick Masonry
Section 04810 - Unit Masonry Assemblies

03600.1.2 SUBMITTALS

Provide description of mix components, which indicates proportions to be used, environmental conditions expected and ad mixture limitations. Indicate type, grade and class of materials which suit the requirements in accordance with Section 01300. Manufacturer's data shall be provided to the ENGINEER for all materials.

03600.1.3 DEFINITIONS

Not used

03600.2 MATERIALS

03600.2.1 PORTLAND CEMENT

Shall meet ASTM C-150, natural color, Type II (normal) or Type IIA (air entraining).

03600.2.2 HYDRATED LIME

Shall meet ASTM C-207, Type S.

03600.2.3 WATER

Shall be potable, or water which meets the requirements of AASHTO T-26.

03600.2.4 GROUT AGGREGATE

Shall be fine aggregate (generally masonry type sand), which meets the requirements of Section 03050 with a maximum particle size specified therein or on the DRAWINGS.

03600.2.5 PORTLAND CEMENT GROUT

Shall be one part Portland Cement to one part grout aggregate proportioned by volume. Mix for 5 minutes with sufficient water to achieve the consistency of thick cream. Minimum Compressive Strength - ASTM C-109, 2800 psi in 28 days.

03600.2.6 SHRINKAGE RESISTANT GROUT

Shall be a pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland Cement, shrinkage compensating agents, plasticizing and water reducing agents.

Minimum Compressive Strength - ASTM C-109, 6500 psi in 28 days. Maximum Shrinkage - ASTM C-827 and ASTM C-157, shall not exceed 0.5 percent.

03600.2.7 EPOXY ADHESIVE GROUT

Shall be two component material suitable for use on dry or damp surfaces and shall comply with ASTM C-881. Minimum Pot Life shall be 5 minutes at 70°F. Minimum Tensile strength - ASTM D-638, 5000 psi in 14 days. Minimum Tensile Elongation - ASTM D-638, 2 percent. Minimum Compressive Strength - ASTM D-695, 6500 psi in 24 hours at 70°F, 12,500 psi in 28 days at 70°F. Maximum Water Absorption - ASTM D-570, 1 percent. Minimum Bond Strength shall be: in Direct Shear - 400 psi; in Direct Tension - 250 psi; in Beam Break - 800 psi.

03600.2.8 MORTAR

Shall be a mixture of grout aggregate, all of which passes the No. 4 sieve size, Portland Cement, hydrated lime, and water blended to form a plastic putty meeting the requirements of ASTM C-270. Mortars for brick or concrete block masonry construction shall be Type S or M, mixed in the proportions indicated in the table shown below and manufactured in accordance with the Uniform Building Code. Type S mortar shall be used in masonry sections above grade and not subject to water submergence. Type M mortar shall be used in locations below grade and/or where water contact potential is high.

MORTAR MIXING PROPORTIONS (by volume)

Mortar	Portland Cement	Hydrated Lime	Clean Sand
Type "S"	1	½	4½
Type "M"	1	0	2½

03600.3 CONSTRUCTION REQUIREMENTS

The CONTRACTOR shall prepare and install grout and mortar materials in accordance with these Specifications. The materials shall be mixed in clean containers, which will not allow contamination from deleterious materials. After mixing, the CONTRACTOR shall immediately install the grout or mortar. Grout or mortar left unused one hour after mixing shall be discarded.

03600.4 METHOD OF MEASUREMENT

03600.4.1 NO MEASUREMENT

Grout for leveling of structural components, sealing joints and gaps, finishing concrete surfaces, and filling masonry cells for structures shall not be measured separately for payment.

Mortar used for installing brick or concrete masonry units, or for finishing concrete surfaces, shall not be measured separately for payment.

03600.4.2 SEPARATE MEASUREMENT

Grout installed under pressure for filling voids and pockets under footings and supporting sections and for sealing ground water movement shall be measured by the cubic foot of grout injected in place.

03600.5 BASIS OF PAYMENT

The accepted quantities shall be paid for at the contract unit price for:

PAY ITEM	UNIT
Grout *(Description)*	Cubic Foot

DIVISION 4

MASONRY

SUNRISE
ENGINEERING

04200.1 DESCRIPTION

This section covers furnishing materials, fasteners, and anchoring devices, accessories, and the labor required to construct masonry walls and other masonry structural features of buildings.

04200.1.1 RELATED WORK

Section 03200 - Concrete Reinforcement
Section 03600 - Grout and Mortar

04200.1.2 SUBMITTALS

04200.1.2.1 DRAWINGS - When called for in these Specifications, the Contractor shall furnish drawings of general construction of forms, jointing, location of ties, and other items affecting visibility. Where special shapes of concrete units are shown on the Drawings, the Contractor shall furnish drawings and detailed descriptions of these units for approval by the Engineer.

04200.1.2.2 MANUFACTURER'S INFORMATION - Submit name of manufacturer, type, size, and grade along with color samples of block units for selection by the Engineer.

04200.1.3 DEFINITIONS

Flashing - sheet metal or plastic placed in brick walls to deflect surface water accumulation onto or away from joints with other structural components such as roof surfaces, foundations, etc.

Wall Ties - metal connectors placed strategically to connect exterior wall veneer sections to interior faces or other structural components.

Lintels - steel or reinforced concrete units installed horizontally over openings in wall sections to support masonry units placed over the opening.

Wythe - a single width of masonry wall units.

04200.2 MATERIALS

04200.2.1 CONCRETE BLOCK UNITS

Shall be hollow, lightweight, Grade N, Type I units meeting the requirements of ASTM C 90.

04200.2.2 MORTAR AND GROUT

Shall meet the requirements of Section 03600. When block opening sizes will allow adequate clearance, aggregate particle size in grout used for bond beams and vertical reinforcement may be increased to 1/2-inch (maximum).

04200.2.3 FLASHINGS

Unless otherwise shown on the Drawings or described in these Specifications, all material used for masonry flashings shall be 22 gauge (minimum) galvanized sheet steel.

04200.2.4 JOINT REINFORCEMENT

Shall be truss type galvanized steel, with 3/16-inch side rods and No. 9 cross ties.

04200.2.5 WALL TIES

Shall be galvanized bent wire, 0.1875-inch (minimum), but not greater than one-half of the mortar joint thickness.

04200.2.6 REINFORCEMENT

Shall be of deformed steel bars of the size shown on the Drawings, meeting the requirements for reinforcement steel in Section 03200.

04200.2.7 CONTROL JOINT FILL MATERIAL

Fill material shall be fully compressible 3/8-inch thick sponge rubber, meeting the requirements of IAW ASTM D-1782, with a minimum resiliency recovery rate of 90% or better, or approved equal.

04200.2.8 SEALER

Shall be a penetrating sealer, such as Pre-Prime 167 manufactured by Devoe Coatings or approved equal.

04200.3 CONSTRUCTION

04200.3.1 MORTAR

All mortar shall be mixed on the job and, with the exception of putty, no mixing off the job, either complete or in part, will be allowed. Materials for mortar shall be measured by volume. Mortar shall be mixed in a mechanical mixer and only in such quantities as are needed for immediate use. Mortar shall be mixed for five minutes after all materials have been placed in the mixer. No mortar which has been mixed for more than one hour shall be used.

04200.3.2 HANDLING AND STORAGE OF MASONRY UNITS

All masonry units shall be transported and handled in such manner as to prevent chipping and breakage. Storage piles, stacks, or bins shall be placed in locations where materials will be protected from damage. Chipped, cracked, or otherwise defective units shall not be laid in the wall where defects may be exposed to view.

04200.3.3 LAYING UP

04200.3.3.1 PREPARATION - Preparation for laying up the masonry work shall proceed as follows:

- The foundation surface on which a masonry wall is to be built shall be clean. When residual material, such as dust, dirt, chips, concrete splatter, etc., is found to be present on the top surface of the foundation wall, the Contractor shall take appropriate measures as deemed necessary by the Engineer to remove such material before starting any masonry course.

- All sills, ledges, offsets and other projections shall be protected from spills or drops of mortar, and all construction by other trades shall be protected from damage which may result from the masonry work.

- Masonry units shall be cured and dried before being used and surface shall be clean and free from dust, dirt, or other foreign matter when laid in the wall. Masonry units shall not be wetted before being used but shall be laid dry.

04200.3.3.2 CONSTRUCTION TOLERANCES - All masonry walls shall be laid in uniform and true courses that are level and plumb. Walls should be plumb to within plus or minus ½-inch per 20 feet. Walls shall be straight horizontally to within plus or minus ¼-inch in 50 feet. Wall thickness shall be as shown on the Drawings with a tolerance of ¼-inch.

04200.3.3.3 BOND PATTERN - Bond pattern for all masonry walls shall be running bond unless otherwise indicated on the Drawings. No jumping of bond will be allowed. Bond shall be plumb throughout.

04200.3.3.4 APPLICATION OF MORTAR – Mortar shall be applied as follows:

- Full mortar bedding shall be used for the first course on the foundation.
- Joint thickness is to be ½ inch both vertically and horizontally unless otherwise shown.
- Full mortar coverage shall be provided on all face shells and on the webs surrounding cells to be filled.
- Vertical head joints shall be well buttered for a thickness equal to the face shell, and these joints shall be shoved together tightly so that the mortar bonds well to both units.
- Joints shall be solidly filled from the face of the units to the depth of the face shell.
- Mortar joints shall be straight, clean and uniform in thickness and shall be tooled concave unless indicated otherwise on the Drawings. However, when walls are to be coated with bitumen damp proofing, mortar joints shall be struck flush with masonry unit faces.

04200.3.3.5 PLACEMENT OF MASONRY – Masonry units shall be placed as follows:

- Before starting the actual lay-up work, masonry shall be laid dry on the foundation wall and bond adjusted to openings, angles and corners.
- No units smaller than ½ block shall be used.
- Masonry units shall be laid in the wall to the desired height with joints of uniform thickness.
- Masonry units shall be adjusted to their final position in the wall, level, plumb, and straight, while the mortar is still soft and plastic enough to ensure a good bond.
- If the position of a unit is shifted after the mortar has stiffened, or the bond is broken or cracks are formed, the unit shall be re-laid in fresh mortar.
- If work has been stopped long enough for mortar to set, both masonry and mortar shall be cleaned before new work is laid up.

04200.3.3.6 CONSTRUCTING AND GROUTING VERTICAL CELLS – This work shall proceed as follows:

- All masonry shall be laid so as to preserve a clear, unobstructed, vertical continuity of the cells to be filled with grout.
- The vertical opening shall measure not less than 2 inches by 3 inches.
- Walls and cross webs forming such cells shall be fully bedded in mortar, to prevent leakage of grout. See also subsection 04200.3.10 below. All head (or end) joints shall be solidly filled

with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells.

- Vertical reinforcement shall be held in position at the top and bottom and at intervals not exceeding 192 diameters of the reinforcement material.

- All vertical cells containing reinforcement shall be filled solidly with grout in individual lifts not to exceed 4 feet in height each.

- Place and consolidate grout fill without disturbing reinforcing. Grout lifts greater than 8-inches shall be mechanically vibrated. Do not consolidate by shaking the vertical bars.

- Whenever grouting is to be stopped for one hour or longer, horizontal construction joints shall be formed by stopping the pour of grout 1½" below the top of the uppermost unit.

04200.3.3.7 BEAMS AND BEARING PLATES - Two courses of grouted hollow masonry shall be provided below all steel bearing plates or beams bearing on masonry walls. At bearing points fill masonry cores with grout a minimum of 24-inches wide from bearing point to lower support member or bond beam. Place external bearings on each side of contact with load as required to properly transfer load to the masonry wall, as indicated on the plans.

Use "H" blocks for bond beams. Reinforce bond beams and pilasters as indicated on the Drawings.

04200.3.4 OPENINGS

04200.3.4.1 METAL DOORFRAMES - Jambs and heads of metal doorframes to be connected to masonry shall be anchored and fully grouted. Filling of doorframes with grout shall be done as each two vertical feet of masonry are laid. Bed anchors of metal doors and glazed frames in mortar joints. Fill frame voids solid with mortar. Fill masonry cores with grout for one core from framed openings.

04200.3.4.2 CUTOUTS - All necessary cutting of masonry units to form chases, etc., for anchorage or other appurtenances shall be part of the Contractor's required work.

- All cutting and fitting of exposed masonry units shall be done with a power driven carborundum or diamond disc blade saw.

- Where masonry is to enclose conduits, pipes, stacks, ducts, and similar items, the necessary slots, chases, cavities, and similar spaces for these items shall be constructed as required, whether indicated on the plans or not.

- The Contractor shall not cover such work until he has been informed that the work has been inspected and tested.

- All openings in exterior masonry around pipes, conduits, etc., shall be caulked weather tight with a silicone rubber product or compound designed for this purpose.

04200.3.5 LINTELS

Where steel or pre-cast concrete lintels are not scheduled, install reinforced masonry unit lintels over openings. Construct or shop-fabricate lintels using grout fill and reinforcing. Maintain 8 inches minimum bearing on each side of opening.. Door, window, and similar openings in

masonry walls, unless indicated or specified otherwise, shall have lintels made up of like material "U" block units reinforced and filled solidly with grout to properly span openings. Do not splice reinforcing bars in lintels. Allow lintels to reach full strength before removing temporary supports.

04200.3.6 REINFORCING

Reinforce as indicated. Lap splices at least 40 bar diameters.

04200.3.7 ANCHORS AND BRACING

Supply metal anchors as shown on the Drawings for anchoring the masonry work to other structural members. Provide temporary dry bracing required during erection of masonry work. Maintain in place until building structure provides permanent bracing.

04200.3.8 MASONRY FLASHINGS

Extend flashing through veneer, turn up a minimum of 8 inches, and bed into mortar joints of masonry or seal substrate as required. Lap end joints 8 inches minimum and seal watertight. Use the flashing manufacturer's recommended sealant.

04200.3.9 CONTROL JOINTS

Control joints, with filler, shall be as shown on the Drawings or as specified herein.

04200.3.9.1 LOCATION - Control joints shall be provided for all vertical masonry walls where such walls exceed 40 feet in length. In longer lengths of walls, joints shall be provided at least every 30 feet or as indicated on the plans. Control joints shall be continuous for the full height of walls.

04200.3.9.2 FORMING - Form control joints by using a sheet, building paper type bond breaker fitted to the hollow contour of the block unit end. Fill the void so created with grout. Rake the joint at the exposed faces of rod and sealant.

04200.3.9.3 REINFORCING - Horizontal joint reinforcing shall not cross control joints. However, at bond beams, control joints shall separate masonry and grout; and steel reinforcing shall be continuous.

04200.3.9.4 FILLER - Control joint fillers shall be installed in continuous lengths in accordance with the manufacturer's instructions. Fill materials shall be held below the finished surface, and the remainder of the joint shall be caulked with synthetic rubber.

04200.3.10 ACCESSORIES

Furnish and install steel or pre-cast concrete components as shown on the Drawings.

Set metal door frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates and other items tight and caulk exterior joints with silicone rubber composition colored to match color of mortar. Place all anchor bolts in solid grouted cores. Build items plumb and level.

04200.3.11 COMPLETION, CLEANUP AND SEALING

04200.3.11.1 DEFECTIVE WORK - At the completion of the work, all defective mortar joints on exposed masonry shall be re-pointed. Where necessary, defective joints shall be cut out and re-pointed.

04200.3.11.2 CLEANING - Brush off excess mortar as work progresses. Dry brush at the end each day's work.

04200.3.11.3 FINAL CLEANING - After mortar is thoroughly set and cured and damaged surfaces are repaired, final cleaning of exposed masonry surfaces shall proceed as follows:

- Dry clean to remove large particles of mortar using wood paddles and scrapers. Use a chisel or wire brush if necessary.
- Scrub down wall with stiff fiber brush and either a solution of ½ cup of trisodium phosphate and ½ cup of household detergent dissolved in 1 gallon of water, or commercial muratic acid mixed in 8-10 parts of clean water, or other approved masonry cleaner.
- Rinse walls by washing off cleaning solution, dirt and mortar crumbs using clean, 100 percent soluble pressurized water.

04200.3.11.4 SEALER – A penetrating sealer shall be applied to concrete block masonry surfaces as shown on the Drawings.

04200.3.12 INSULATING FILL IN WALLS

Exterior walls of all buildings having internal cells in the block and that are not filled with grout shall be filled with insulation. Insulation shall be foamed-in-place insulation as specified in Division 7. The cells in the block wall shall be kept as free of mortar as possible as the work goes up. The brick laying shall not be carried more than four feet vertically ahead of the insulation fill. That is, the insulation shall be foamed in place in lifts not to exceed four feet. Care shall be taken that no insulating fill gets into cells which are to be filled with grout and that no grout gets into cells that are to be filled with insulation.

04200.4 METHOD OF MEASUREMENT

Unless provided otherwise in the Special Provisions, concrete block masonry will be measured as part of the building or structure listed in the Bid Schedule and no separate measurement will be made.

04200.5 BASIS OF PAYMENT

Separate payment for concrete block masonry will not be made unless indicated otherwise in the Special Provisions.

04810.1 DESCRIPTION

04810.1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

04810.1.2 SUMMARY

04810.1.2.1 This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Face brick.
4. Mortar and grout.
5. Reinforcing steel.
6. Masonry joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.
10. Cavity-wall insulation.

04810.1.2.2 Related Sections include the following:

1. Division 3 Section “Grout & Mortar.”
2. Division 7 Section “Masonry Block Course Fill Insulation”.
3. Division 5 Section “Miscellaneous Metal Fabrications” for steel fabrications associated with unit masonry assemblies.

04810.1.2.3 Products furnished, but not installed, under this Section include the following:

1. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 5 Section “Structural Steel.”

04810.1.2.4 Products installed, but not furnished, under this Section include the following:

1. Steel lintels for unit masonry, furnished under Division 5 Section “Metal Fabrications.”
2. Manufactured reglets in masonry joints for metal flashing, furnished under Division 7 Section “Sheet Metal Flashing and Trim.”
3. Hollow-metal frames in unit masonry openings, furnished under Division 8 Section “Steel Doors and Frames”.

04810.1.3 DEFINITIONS

Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

04810.1.4 PERFORMANCE REQUIREMENTS

Provide unit masonry that develops the following net-area compressive strengths (fm) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530/ASCE 6/TMS 602.

1. For Concrete Unit Masonry: f’m = 2000 psi (13.8 MPa).
2. For Brick Unit Masonry: f’m = 3000 psi (20.7 MPa).

04810.1.5 SUBMITTALS

04810.1.5.1 Product Data: For each different masonry unit, accessory, and other manufactured product specified.

04810.1.5.2 Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

04810.1.5.3 Samples for Initial Selection: For the following:

1. Unit masonry Samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.

2. Colored mortar Samples showing the full range of colors available.

04810.1.5.4 Samples for Verification: For the following:

1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.

04810.1.5.5 Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:

1. Each type of masonry unit required.

    a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
    b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Mortar complying with property requirements of ASTM C 270.

3. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.

04810.1.5.6 Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.

    a. Include size-variation data for brick and block, verifying that actual range of sizes falls within specified tolerances.
    b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.

3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530/ASCE 6/TMS 602.

4. Each material and grade indicated for reinforcing bars.

5. Each type and size of joint reinforcement.

6. Each type and size of anchor, tie, and metal accessory.

04810.1.5.7 Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

04810.1.6 QUALITY ASSURANCE

04810.1.6.1 Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

04810.1.6.2 Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

04810.1.6.3 Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

04810.1.6.4 Sample Panels: Before installing unit masonry, build sample panels, using materials indicated for the completed Work, to verify selections made under sample Submittals and to demonstrate aesthetic effects. Build sample panels for each type of exposed unit masonry assembly in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness.

1. Locate panels in the locations indicated or, if not indicated, as directed by Engineer.

2. Clean exposed faces of panels with masonry cleaner indicated.

3. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.

4. Protect approved sample panels from the elements with weather-resistant membrane.

5. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.

6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Engineer in writing.

    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels, unless such deviations are specifically approved by Engineer in writing.

7. Demolish and remove sample panels when directed.

04810.1.7 DELIVERY, STORAGE, AND HANDLING

04810.1.7.1 Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

04810.1.7.2 Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

04810.1.7.3 Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

04810.1.7.4 Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

04810.1.7.5 Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

04810.1.8 PROJECT CONDITIONS

04810.1.8.1 Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.

2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

04810.1.8.2 Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

04810.1.8.3 Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

04810.1.8.4 Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

04810.1.8.5 Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

04810.2 MATERIALS

04810.2.1 CONCRETE MASONRY UNITS

04810.2.1.1 General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

2. Provide bullnose units for outside corners, unless otherwise indicated.

04810.2.1.2 Concrete Masonry Units: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 Mpa)

2. Weight Classification: Light weight

3. Size (Width): Manufactured to the following dimensions:

   a. 4 inches (102 mm) nominal; 3-5/8 inches (92 mm) actual.
   b. 6 inches (152 mm) nominal; 5-5/8 inches (143 mm) actual.
   c. 8 inches (203 nun) nominal; 7-5/8 inches (194 mm) actual.
   d. 10 inches (254 mm) nominal; 9-5/8 inches (244 mm) actual.
   e. 12 inches (305 mm) nominal; 11-5/8 inches (295 mm) actual.

4. Exposed Faces: Manufacturer’s standard color and texture for painting with thin film coatings, unless otherwise indicated.

   a. Where units are to be left exposed, provide color and texture matching the range represented by Engineer’s sample.

04810.2.1.3 Decorative Concrete Masonry Units: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 Mpa).

2. Weight Classification: Lightweight

3. Provide Type I, moisture-controlled units.

4. Size: Manufactured to dimensions indicated for non-decorative units.

5. Finish: Exposed faces of the following general description matching color, pattern, and texture of Engineer's samples.

   a. Light weight aggregate, split face finish with integral color.
   b. Color as selected by Engineer from manufacturer's full color palette.

6. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Block Plus W-10; Addiment Inc.
      2) Dry-Block; W. R. Grace & Co., Construction Products Division.
      3) Rheopel; Master Builders.

04810.2.2 BRICK

04810.2.2.1 General: Provide shapes indicated and as follows for each form of brick required:

1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.

04810.2.2.2 Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

04810.2.2.3 Face Brick: ASTM C 216, Grade SW, Type FBX, and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa)

2. Initial Rate of Absorption: Less than 20 g/30 sq. in. (20 g/l 94 sq. cm) per minute when tested per ASTM C 67.

3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."

4. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).

5. Size: Manufactured to the following actual dimensions:

   a. Closure Modular: 3½ to 3-5/8 inches (89 to 92 mm) wide by 3½ to 3-5/8 inches (89 to 92 mm) high by 7½ to 7-5/8 inches (190 to 194 mm) long.

6. Application: Use where brick is exposed, unless otherwise indicated.

7. Color and Texture: Medium brown, velour.

8. Products: Subject to compliance with requirements.

04810.2.3 MORTAR AND GROUT MATERIALS

04810.2.3.1 Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

04810.2.3.2 Hydrated Lime: ASTM C 207, Type S.

04810.2.3.3 Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

04810.2.3.4 Mortar Cement: ASTM C 1329

04810.2.3.5 Masonry Cement: ASTM C 91

04810.2.3.6 Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

04810.2.3.7 Aggregate for Grout: ASTM C 404.

04810.2.3.8 Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

04810.2.3.9 Water: Potable.

04810.2.3.10 Products: Subject to compliance with requirements, provide one of the following:

1. Mortar Cement:

   a. Magnolia Superbond Mortar Cement; Blue Circle Cement.
   b. Lafarge Mortar Cement; Lafarge Corporation.

2. Cold-Weather Admixture:

   a. Accelguard 80; Euclid Chemical Co.
   b. Morseled; W. R. Grace & Co., Construction Products Division.
   c. Trimix-NCA; Sonnebom, Div. of ChemR.ex, Inc.

04810.2.4 REINFORCING STEEL

Uncoated Steel Reinforcing Bars: ASTM A 615/A 61 5M; ASTM A 616/A 61 6M, including Supplement 1; or ASTM A 617/A 617M, Grade 60 (Grade 400).

04810.2.5 MASONRY JOINT REINFORCEMENT

04810.2.5.1 General: ASTM A 951 and as follows:

1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
2. Wire Size for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
3. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
4. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units where indicated.

04810.2.5.2 For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches (407 mm) o.c.

04810.2.5.3 For multi-wythe masonry, provide types as follows:

1. Adjustable (2-piece) type with single pair of side rods and cross ties spaced not more than 16 inches (407 mm) o.c. and with separate adjustable veneer ties engaging the cross ties. Cross ties are either U-shaped with eyes or rectangular. Space side rods for embedment within each face shell of backup wythe and size adjustable ties to extend at least halfway through outer wythe but with at least 5/8-inch (16-mm) cover on outside face.
   a. Use where indicated and where horizontal joints of facing wythe do not align with those of backup wythe.
   b. Use where facing wythe is of different material than backup wythe.

04810.2.6 TIES AND ANCHORS, GENERAL

04810.2.6.1 General: Provide ties and anchors, specified in subsequent Specifications, made from materials that comply with this Specification, unless otherwise indicated.

04810.2.6.2 Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with AS1'M A 153, Class B-2 coating.

04810.2.6.3 Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.

04810.2.7 BENT WIRE TIES

04810.2.7.1 General: Rectangular units with closed ends and not less than 4 inches (100 mm) wide. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.

1. Where coursing between wythes does not align, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1-1/4 inches (32 mm).
2. Where wythes are of different materials, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1-1/4 inches (32 mm).

04810.2.7.2 Wire: Fabricate from 3/16-inch (4.8-mm) diameter, hot-dip galvanized steel.

04810.2.8 ADJUSTABLE ANCHORS FOR CONNECTING TO STEEL FRAME

04810.2.8.1 General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section: Deformed strap nominal 3/4 inch width x nominal 7 inch length, hot-dip galvanized steel strap anchor section for welding to steel or tapcon anchor to concrete masonry units.

2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.1875-inch (4.8-mm) diameter, hot-dip galvanized steel wire.

04810.2.9 ANCHORS FOR CONNECTING TO CONCRETE AND PRECAST WALL PANELS

04810.2.9.1 General: Provide assemblies that allow vertical adjustment but resist tension and compression forces perpendicular to plan of wall.

1. Anchor Section: Dovetail anchor section formed from 0.0966-inch (2.5-mm) thick, steel sheet, galvanized after fabrication.

2. Dovetail Tie Section: Corrugated strap tie with drip leg sized to extend within 1 inch (25 mm) of masonry face, made from 0.1084 (2.7 mm) hot-dip galvanized steel.

04810.2.10 RIGID ANCHORS

General: Fabricate from steel bars as follows:

1. 1½ inches (38 mm) wide by ¼ inch (6.4 mm) thick by 24 inches (600 mm) long, with ends turned up 2 inches (50 mm) or with cross pins.

2. As indicated.

3. Finish: Hot-dip galvanized to comply with ASTM A 153.

04810.2.11 ADJUSTABLE MASONRY-VENEER ANCHORS

04810.2.11.1 General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

1. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

04810.2.11.2 Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie section and a metal anchor section complying with the following requirements:

1. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2¾ inches (70 mm) wide by 3 inches (75 mm) high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.

2. Anchor Section: Sheet metal plate with screw holes top and bottom and with raised rib-stiffened strap stamped into center to provide a slot between strap and plate for connection of wire tie.

a. Plate 1¼ inches (32 mm) wide by 6 inches (150 mm) long with strap 5/8 inch (16 mm) wide by 5-1/2 inches (140 mm) long; slot clearance formed between face of plate and back of strap shall not exceed diameter of wire tie by more than 1/32 inch (0.8 mm).

3. Anchor Section: Gasketed sheet metal plate with screw holes top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap stamped into center to provide a slot between strap and plate for connection of wire tie.

   a. Plate 1¼ inches (32 mm) wide by 6 inches (150 mm) long with strap 5/8 inch (16 mm) wide by 6 inches (150 mm) long; slot clearance formed between face of plate and back of strap shall not exceed diameter of wire tie by more than 1/32 inch (0.8 mm).
   b. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and to prevent moisture from penetrating sheathing at pronged legs and screw holes.

4. Anchor Section: Zinc-alloy barrel section with flanged head with eye and corrosion - resistant, self-drilling screw. Eye designed to receive tie section and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.

5. Wire Tie Section: Rectangular-shaped wire tie sized to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.

6. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0966-inch (2.5-mm) thick, steel sheet, galvanized after fabrication.

7. Fabricate wire tie sections from 0.1875-inch (4.8-mm) diameter, hot-dip galvanized steel wire.

04810.2.11.3 Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange by not less than 3 exposed threads, and with the following corrosion protective coating:

1. Organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B117.

04810.2.11.4 Products: Subject to compliance with requirements, provide one of the following:

1. Screw-Attached, Masonry-Veneer Anchors:

   a. D/A 213; Dur-O-Wal, Inc.
   b. D/A 210 with D/A 700-708; Dur-O-Wal, Inc.
   c. 315-D with 316; Heckman Building Products, Inc.
   d. Pos-I-Tie; Heckman Building Products, Inc.
   e. DW-10; Hohmann & Barnard, Inc.
   f. DW-1OHS; Hohmann & Barnard, Inc.
   g. DW-l0-X; Hohmann & Barnard, Inc.
   h. 1004, Type ifi; Masonry Reinforcing Corporation of America.
   i. RJ-71 1; Masonry Reinforcing Corporation of America.

2. Organic-Polymer-Coated, Steel Drill Screws:

    a. Dril-Flex; Elco Industries, Inc.
    b. Traxx; ITW-Buildex.
    c. Engineer Approved Equal

04810.2.12 MISCELLANEOUS ANCHORS

04810.2.12.1 Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

1. Headed bolts.

2. Nonheaded bolts, bent in manner indicated.

04810.2.12.2 Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Type: Chemical anchors.

2. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

3. For Post installed Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.

4. For Post installed Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

04810.2.13 EMBEDDED FLASHING MATERIALS

04810.2.13.1 Contractor's Option for Concealed Flashing: For flashing partly exposed to the exterior, use metal flashing specified above. For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: Manufacturer's standard laminated flashing consisting of 5-oz./sq. ft. (1.5-kg/sq. m) sheet copper bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

2. Asphalt-Coated Copper Flashing: Manufacturer's standard product consisting of 5-oz./sq. ft. (1.5-kg/sq. m) sheet copper coated with flexible asphalt. Use only where flashing is fully concealed in masonry.

3. Rubberized-Asphalt Flashing: Manufacturer's standard composite flashing product consisting of a pliable and highly adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of 0.040 inch (1.0mm)

4. Elastomeric Thermoplastic Flashing: Manufacturer's standard composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy 0.040 inch (1.0 mm) thick.

a. Provide flashing as a complete system with preformed corners, end dams, other special shapes, and seaming materials; all produced by flashing sheet manufacturer.

04810.2.13.2 Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by the flashing manufacturer for bonding flashing sheets to each other and to substrates.

04810.2.13.3 Products: Subject to compliance with requirements, provide one of the following:

1. Copper-Laminated Flashing:

   a. Copper Fabric Flashing; Advanced Building Products, Inc.
   b. Copper Fabric; AFCO Products, Inc.
   c. H & B C-Fab Flashing; Hohmann & Barnard, Inc.
   d. Type FCC-Fabric Covered Copper; Phoenix Building Products.
   e. Copper Fabric Flashing; Polytite Manufacturing Corp.
   f. Copper Fabric Flashing; Sandell Manufacturing Co., Inc.
   g. York Copper Fabric Flashing; York Manufacturing, Inc.

2. Asphalt-Coated Copper Flashing:

   a. Cop-R-Cote; Advanced Building Products, Inc.
   b. Cop-A-Cote; AFCO Products, Inc.
   c. H & B C-Coat Flashing; Hohmann & Barnard, Inc.
   d. Type ACC-Asphalt Bituminous Coated; Phoenix Building Products.
   e. Coated Copper Flashing; Polytite Manufacturing Corp.
   f. Coated Copper Flashing; Sandell Manufacturing Co., Inc.
   g. Copperseal; York Manufacturing, Inc.

3. Rubberized-Asphalt Flashing:

   a. Dur-O-Barrier; Dur-O-Wal, Inc.
   b. Perm-A-Barrier Wall Flashing; W. R. Grace & Co., Construction Products Division.
   c. Textroflash; Hohmann & Barnard, Inc.
   d. Poly-Bamer Self-Adhering Wall Flashing; Polytite Manufacturing Corp.
   e. Polyguard 300; Polyguard Products, Inc.
   f. Everlastic MF-40; Williams Products, Inc.

4. Elastomeric Thermoplastic Flashing: Hyload Flashing Membrane; Hyload Cloaked Flashing System.

04810.2.14 MISCELLANEOUS MASONRY ACCESSORIES

04810.2.14.1 Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2Al; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

04810.2.14.2 Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.

04810.2.14.3 Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with AS1'M D 226, Type I (No. 15 asphalt felt).

04810.2.14.4 Wicking Material: Cotton or polyester rope, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes.

04810.2.14.5 Cavity Drainage Material: ¾ inch (19-mm) thick, free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings.

04810.2.14.6 Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.187-inch (4.8-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

04810.2.14.7 Products: Subject to compliance with requirements, provide one of the following:

1. Cavity Drainage Material:

    a. Mortar Break; Advanced Building Products, Inc.
    b. CavClear Masonry Mat; CavClear.
    c. Mortar Net; Mortar Net USA, Ltd.
    d. Mortar Stop; Polytite Manufacturing Corp.

2. Reinforcing Bar Positioners:

    a. D/A 811; Dur-O-Wal, Inc.
    b. D/A 816; Dur-O-Wal, Inc.
    c. No. 376 Rebar Positioner; Heckman Building Products, Inc.
    d. #RB Rebar Positioner; Hohmann & Barnard, Inc.
    e. #RB-Twin Rebar Positioner; Hohmann & Barnard, Inc.
    f. Double 0-Ring Rebar Positioner; Masonry Reinforcing Corporation of America.
    g. 0-Ring Rebar Positioner; Masonry Reinforcing Corporation of America.

04810.2.15 CAVITY-WALL INSULATION

04810.2.15.1 Extruded-Polystyrene Board Insulation: Rigid, cellular, polystyrene thermal insulation with closed cells and integral high-density skin; formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578, Type IV.

04810.2.15.2 Adhesive: Type recommended by insulation board manufacturer for application indicated.

04810.2.16 MASONRY CLEANERS

Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0. 14-L) dry measure laundry detergent dissolved in I gal. (4 L) of water.

04810.2.17 MORTAR AND GROUT MIXES

04810.2.17.1 General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

04810.2.17.2 Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

04810.2.17.3 Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.

04810.2.17.4 Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.

1. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
2. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement, mortar cement, and lime.
3. For masonry below grade, in contact with earth, and where indicated, use Type S.
4. For reinforced masonry and where indicated, use Type S.
5. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N or RN.
6. For interior non-load-bearing partitions, use Type N.

04810.2.17.5 Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530. l/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTMC 143.

04810.3 EXECUTION

04810.3.1 EXAMINATION

04810.3.1.1 The Contractor shall examine conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Contractor, listing conditions detrimental to performance.

2. Verify that foundations are within tolerances specified.

3. Verify that reinforcing dowels are properly placed.

4. Proceed with installation only after unsatisfactory conditions have been corrected.

04810.3.1.2 Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

04810.3.2 INSTALLATION, GENERAL

04810.3.2.1 Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths

indicated.

04810.3.2.2 Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

04810.3.2.3 Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

04810.3.2.4 Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

04810.3.2.5 Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

04810.3.2.6 Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

04810.3.2.7 Wetting of Brick: Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/l 94 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

04810.3.3 CONSTRUCTION TOLERANCES

04810.3.3.1 Comply with tolerances in ACI 530. 1/ASCE 6/TMS 602 and the following:

04810.3.3.2 For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

04810.3.3.3 For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

04810.3.3.4 For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

04810.3.3.5 For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).

04810.3.3.6 For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

04810.3.4 LAYING MASONRY WALLS

04810.3.4.1 Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thickness and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

04810.3.4.2 Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses

above and below.

04810.3.4.3 Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

04810.3.4.4 Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

04810.3.4.5 Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

04810.3.4.6 Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

04810.3.4.7 Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

04810.3.4.8 Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

04810.3.4.9 Build non-load-bearing interior partitions to indicated heights.

04810.3.5 MORTAR BEDDING AND JOINTING

04810.3.5.1 Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.

2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

04810.3.5.2 Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

04810.3.5.3 Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

04810.3.6 BONDING OF MULTIWYTHE MASONRY

04810.3.6.1 Use masonry joint reinforcement installed in horizontal mortar joints to bond wythes together.

04810.3.6.2 Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated “L” units as well as masonry bonding.

04810.3.6.3 Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide continuity with masonry joint reinforcement by using prefabricated “T” units.
2. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

04810.3.7 CAVITIES

04810.3.7.1 Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.

1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.

2. Provide temporary opening by omitting 1 brick every 48 inches (1200 mm) at bottom of cavity and in first course above flashing. After wall has been built to top of cavity and mortar has set, clean out cavity and then close temporary opening.

04810.3.7.2 Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

04810.3.8 MASONRY JOINT REINFORCEMENT

04810.3.8.1 General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, ½ inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.

2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.

3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.

    a. Reinforcement above is in addition to continuous reinforcement.

04810.3.8.2 Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

04810.3.8.3 Provide continuity at corners and wall intersections by using prefabricated “L” and “T” sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

04810.3.9 ANCHORING MASONRY TO STRUCTURAL MEMBERS

04810.3.9.1 Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch (25 mm) in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other

rigid materials.

2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and horizontally.

04810.3.10 ANCHORING MASONRY VENEERS

Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten each anchor section through sheathing to wall framing with two metal fasteners of type indicated.

2. Fasten anchors through sheathing to wall framing with metal fasteners of type indicated.

3. Insert anchor sections in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.

4. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.

5. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

6. Space anchors as indicated, but not more than 16 inches (408 mm) o.c. vertically and 16 inches (407 mm) o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around the perimeter.

04810.3.11 CONTROL AND EXPANSION JOINTS

04810.3.11.1 General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

04810.3.11.2 Form control joints in concrete masonry as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block.

2. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.

04810.3.11.3 Form expansion joints in brick made from clay or shale as follows:

1. Form open joint of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Division 7 Section “Joint Sealants.” Keep joint free and clear of mortar.

04810.3.12 LINTELS

04810.3.12.1 Install steel lintels where indicated.

04810.3.12.2 Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

1. Provide prefabricated or built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

04810.3.12.3 Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

04810.3.13 FLASHING, WEEP HOLES, AND VENTS

04810.3.13.1 General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

04810.3.13.2 Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

04810.3.13.3 Install flashing as follows:

1. At multi-wythe masonry walls, including cavity walls, extend flashing from exterior face of outer wythe of masonry, through outer wythe, turned up a minimum of 8 inches (200 mm), and through inner wythe to within 1/2 inch (13 mm) of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through inner wythe and turn flashing up approximately 2 inches (50 mm), unless otherwise indicated.

2. At masonry-veneer walls, extend flashing from exterior face of veneer, through veneer, up face of sheathing at least 8 inches (200 mm), and behind air-infiltration barrier or building paper.

3. At lintels and shelf angles, extend flashing a minimum of 4 inches (100 mm) into masonry at each end. At heads and sills, extend flashing 4 inches (100 mm) at ends and turn flashing up not less than 2 inches (50 mm) to form a pan.

4. Extend sheet metal flashing ½ inch (13 mm) beyond face of masonry at exterior and turn flashing down to form a drip.

5. Install metal drip edges beneath flashing at exterior face of wall. Stop flashing ½ inch (13 mm) back from outside face of wall and adhere flashing to top of metal drip edge.

6. Install metal flashing termination beneath flashing at exterior face of wall. Stop flashing ½ inch (13 mm) back from outside face of wall and adhere flashing to top of metal flashing termination.

7. Cut flashing off flush with face of wall after masonry wall construction is completed.

04810.3.13.4 Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:

1. Use wicking material to form weep holes.

2. Use wicking material to form weep holes above flashing in brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.

3. Space weep holes formed from wicking material 16 inches (400 mm) o.c.

4. Place cavity drainage material immediately above flashing in cavities.

04810.3.13.5 Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

04810.3.14 REINFORCED UNIT MASONRY INSTALLATION

04810.3.14.1 Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

04810.3.14.2 Placing Reinforcement: Comply with requirements of ACI 530. 1/ASCE 6/TMS 602.

04810.3.14.3 Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of ACI 530. 1/ASCE 6iTMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

04810.3.15 FIELD QUALITY CONTROL

04810.3.15.1 Owner may elect to engage a qualified independent testing agency to perform field quality-control testing indicated below.

1. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

04810.3.15.2 Testing Frequency: Tests and Evaluations listed in this specification will be performed during construction for each 5,000 sq. ft. (465 sq. m) of wall area or portion thereof.

04810.3.15.3 Mortar properties will be tested per ASTM C 780.

04810.3.15.4 Grout will be sampled and tested for compressive strength per ASTM C 1019.

04810.3.16 REPAIRING, POINTING, AND CLEANING

04810.3.16.1 Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh

mortar, pointed to eliminate evidence of replacement.

04810.3.16.2 Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

04810.3.16.3 In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar splatters and smears before tooling joints.

04810.3.16.4 Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Engineer's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.

5. Clean brick by the bucket-and-brush hand-cleaning method.

6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

04810.3.17 MASONRY WASTE DISPOSAL

Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

04810.4 METHOD OF MEASUREMENT

Unless provided otherwise in the Special Provisions, concrete block masonry will be measured as part of the building or structure listed in the Bid Schedule and no separate measurement will be made.

04810.5 BASIS OF PAYMENT

Separate payment for concrete block masonry will not be made unless indicated otherwise in the Special Provisions.

DIVISION 5

METALS

SUNRISE
ENGINEERING

05010.1 GENERAL

This section of the Specifications covers metals and metal work required to furnish, fabricate, and to install the following nonexclusive list of items:

- Aluminum and miscellaneous nonferrous metals
- Anchors and anchor bolts
- Bolts
- Cast-iron frames and covers
- Grating and frames
- Ladders
- Louvers
- Manhole frames and covers
- Metal roof decking
- Miscellaneous metal items shown on the Plans or specified
- Miscellaneous structural steel
- Pipe handrails, pipe sleeves, inserts, and chains
- Platforms
- Sheet metalwork
- Special supports, hangers, and anchors
- Stairs and treads
- Steel lintels
- Supports for mechanical equipment
- Tread plates and frames

05010.1.2 RELATED WORK

Not used.

05010.1.3 SUBMITTALS

Certified copies, in duplicate, of mill tests or reports from a recognized commercial laboratory shall be furnished when requested as to the chemical, tensile, and bending properties of each shipment of structural metal or part thereof having common properties. All tests and analyses shall be made in accordance with the applicable ASTM Specification.

05010.1.4 DEFINITIONS

Not used.

05010.2 MATERIALS

05010.2.1 ALUMINUM

05010.2.1.1 SHEET ALUMINUM - Except as otherwise specified or indicated on the Plans, sheet aluminum shall be alloy 50050H14 conforming to the requirements of ASTM B 209 and shall be not less than 0.025 inch in thickness.

05010.2.1.2 STRUCTURAL ALUMINUM - Structural aluminum shall be 6061-T6, and extruded aluminum shall be 6063-T42.

Aluminum shapes and appurtenant materials shall conform to the requirements of ASTM B 221 and ASTM B 308 and shall be of aluminum alloy known commercially as 6061-T6. Materials not otherwise specified shall conform to the latest applicable Specifications of ASTM.

05010.2.1.3 BOLTS - All bolts for bolting aluminum shall be Type 304 or 316 stainless steel of sizes indicated on the Plans.

05010.2.2 STEEL

05010.2.2.1 SHEET STEEL - Galvanized sheet iron or steel shall conform to ASTM A 525, 1.25-ounce coating; black steel to ASTM A 569.

05010.2.2.2 STRUCTURAL STEEL – Structural steel shall be as follows:

- Unless otherwise specified, structural steel shall conform to ASTM A 36.
- Cast iron shall conform to ASTM A 48, Class 40B.
- Galvanized structural steel or iron shall be "hot dipped" galvanized after fabrication. Electro-galvanizing shall not be used unless specified otherwise.
- All structural steel shall be delivered free from mill scale, rust, or pitting.
- Items not galvanized or protected by a shop coat of paint shall be protected from the weather until erection and painting.

05010.2.2.3 STAINLESS STEEL - Stainless steel, unless specifically specified or indicated on the Plans otherwise, shall be Type 316 or Type 304, nonmagnetic.

05010.2.2.4 STEEL PIPE - Steel pipe shall conform to ANSI B 36.10, Table I.

05010.2.2.5 BOLTS - High tensile bolts shall conform to ASTM A 325.

05010.2.2.6 OTHER ITEMS

Other structural and miscellaneous metal items shall be as indicated on the Plans or as specified elsewhere.

05010.3 CONSTRUCTION (FABRICATION) REQUIREMENTS

05010.3.1 GENERAL

All structural or foundry items shall be carefully fabricated to true dimensions without warp or twist. Welded closures shall be neatly made; and where weld material interferes with fit or is unsightly in appearance, it shall be ground off smooth.

05010.3.1.1 INSTALLATION - Each structural item shall be installed true to level, plumb, alignment, and grade with all parts bearing or fitting the structure or equipment for which it is intended accurately and securely. It shall not be permitted to cock out of alignment, re-drill, reshape, or force to fit any fabricated item. It is the Contractor's responsibility to place anchor bolts or other anchoring devices accurately and to make any surfaces, which bear against structural items smooth and true to level to preclude the necessity of any springing, re-drilling, or reshaping.

05010.3.1.2 SPECIAL ALIGNMENT - Pipe railings, posts, and structural items needing a special alignment to preserve straight, level, even, smooth lines shall be rigidly supported and braced and kept braced until concrete, grout, or dry pack cement mortar has hardened for a period of not less than 48 hours.

05010.3.1.3 FIT - The Contractor shall be responsible for the correct fitting of all metalwork in the field. The Contractor shall take all measurements necessary to properly fit its work in the field, and it shall be governed by and be responsible for these measurements and the proper working out of all details.

05010.3.1.4 WELDING – General welding procedures are as follows (see also Subsections below):

- The Contractor shall notify the Engineer at least 24 hours before starting shop or field welding.
- A welding inspector may check the materials, the equipment, and the qualifications of the welders.
- The inspector may use gamma ray, magnetic particle, dye penetrant, trepanning, or any other aid to visual inspection which it may deem necessary to be assured of the adequacy of the welding.
- The costs of any tests and all re-tests on defective welds shall be borne by the Contractor. Cost in connection with qualifying welders shall also be borne by the Contractor.
- The cost of tests on sound welds will be borne by the Owner.
- Welders doing unsatisfactory work shall be removed or may be required to pass qualification tests again.

05010.3.1.5 MISCELLANEOUS METALWORK - Where anchors, connections, or other details of miscellaneous metalwork are not definitely shown or specified, its material, size, form, attachment, and location shall conform to best practice.

05010.3.1.6 HAZARDOUS PROJECTIONS - Sharp or hazardous projections shall be rounded off and ground smooth.

05010.3.1.7 CHIPS AND DEBRIS - All chips and other debris lodged between contacting surfaces shall be removed before assembly.

05010.3.2 ALUMINUM

05010.3.2.1 STRUCTURAL ALUMINUM

The Contractor shall furnish and install all structural aluminum items in accordance with the Plans and as specified. It shall provide all supplementary parts necessary to complete each item even though such work is not definitely covered by the Plans and Specifications. Its size, form, attachment, and location shall be such as to conform to the best of current practice.

05010.3.2.2 LAYOUT ON ALUMINUM - Hole centers may be center punched and cutoff lines may be punched or scribed. Center punching and scribing shall not be used where such marks would remain visible on the surface of the fabricated material.

When critical dimensions exist, a temperature correction shall be applied in the layout as necessary. The coefficient of expansion shall be taken as 0.000013 per degree F.

05010.3.2.3 CUTTING AND DRILLING ALUMINUM – Aluminum may be cut and drilled as follows:

- Material 1/2 inch thick or less may be sheared, sawed, or cut with a router. Material more than 1/2 inch thick shall be sawed or routed.
- Cut edges shall be true, smooth, and free from excessive burrs or ragged breaks.
- Edges of plates carrying calculated stresses shall be planed to a depth of 1/4 inch. Sawn or routed edges will be acceptable when the finish is of equal quality to a planed edge.
- Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.
- Rivet or bolt holes may be punched or drilled to finished size before assembly.
- The finished diameter of holes for unfinished bolts shall be not more than 1/16 inch larger than the nominal bolt diameter.
- All holes shall be cylindrical and perpendicular to the principal surface. Holes shall not be drifted in such a manner as to distort the metal.
- Flame cutting of aluminum alloys is not permitted.

05010.3.2.4 ALUMINUM FORMING AND ASSEMBLY - Structural aluminum material may not be heated except in forming operations where material may be heated to a temperature not exceeding 400 degrees F for a period not exceeding 30 minutes to facilitate bending. Such heating shall be done only when proper temperature controls and supervision are provided to insure that the limitations on temperature and time are carefully observed.

05010.3.2.5 WELDING ALUMINUM - This Specification shall apply to both field and shop welding operations. The general recommendations and regulations shown in the American Welding Society Specifications D1.1, "Structural Welding Code," apply to 6061-T6 structures. Detail requirements for welding aluminum alloy 6061-T6 are given as follows:

- Filler metal for welding shall be aluminum alloy welding rods conforming to the requirements of AWS A 5.10 and shall be AWS classification ER 4043, ER 5154, ER 5254, ER 5183, ER 5356, or ER 5556.
- The welding process and welding operators shall both meet a qualification tests. The method of qualification shall conform to the method described in the ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications," Part B. Aluminum alloy 6061-T6 shall be used for the qualification test plates. Operators shall be qualified on the basis on bend tests and a fillet weld soundness test.
- Dirt, grease, forming or machining lubricants, or any organic materials shall be removed from the areas to be welded by cleaning with a suitable solvent or by vapor degreasing. Additional operations to remove the oxide coating just prior to welding are required when the inert gas tungsten arc welding method is used. This may be done by etching or by scratch brushing. The oxide coating may not need to be removed if the welding is done with the automatic or semi-automatic inert gas shielded metal arc.

- Suitable edge preparation to assure 100 percent penetration in butt welds shall be used. Oxygen cutting shall not be used. Sawing, chipping, machining or shearing may be used.

- Any welding of aluminum shall be done using a nonconsumable tungsten electrode with filler metal in an inert gas atmosphere (TIG) or using a consumable filler metal electrode in an inert gas atmosphere (MIG). No welding process that requires the use of a welding flux shall be used unless prior approval has been obtained from the Engineer. Preheating for welding is permissible provided the temperature does not exceed 400° F for a total time of 30 minutes.

- Welding of any structure which is to be anodized shall be done using filler alloy rods that will not discolor when anodized. ER 5154, ER 5254, ER 5183, ER 5356, or ER 5556 filler alloy rods shall be used.

05010.3.2.6 PROTECTION OF ALUMINUM SURFACES - Aluminum surfaces to be placed in contact with wood, concrete, masonry, or dissimilar metals other than stainless steel shall be protected as specified in the appropriate sections of Division 9 – Finishes.

05010.3.2.7 BOLTING - Where aluminum comes in contact with steel it shall be bolted with stainless steel bolts and separated or isolated from the steel with neoprene gaskets or washers or as specified in Division 9.

05010.3.3 STEEL

05010.3.3.1 STRUCTURAL STEEL – The following shall apply:

- The Contractor shall furnish and install all structural steel items in accordance with the plans and as specified herein.

- The Contractor also shall provide all supplementary parts necessary to complete each item even though such work may not be specifically covered by the Plans and Specifications.

- Wherever applicable, all fabrication and erection of steel items shall conform to AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings" except as the same may be modified by applicable building codes, the General Conditions, and these Specifications.

05010.3.3.2 WELDING OF STEEL – Both the general recommendations and regulations shown in the American Welding Society Specifications D1.1, "Structural Welding Code," as well as the detail requirements in those specifications apply to welding of steel structures. Welding of steel shall adhere to the following:

- All welding of steel under this section shall be done by welders who have a current AWS certificate for the type of welding to be done by the welder.

- All welding of structural steel type ASTM A 36 shall be done using mild steel covered Arc Welding Electrodes conforming to ASTM A 233, Series E70, or shall be done using Electrodes and Fluxes for Submerged Arc Welding conforming to ASTM A 558, Classification F70-XXXXX, where XXXXX refers to any electrode referred to in ASTM A 558.

- Welding of stainless steels shall be done with electrodes and techniques as recommended in Welded Austenitic Chromium - Nickel Stainless Steels - Techniques and Properties as

published by the International Nickel Company, Inc., New York, New York. All welds shall be full penetration welds, unless specified otherwise.

05010.3.3.3 PROTECTION OF STEELWORK - The Contractor shall paint steel and miscellaneous ferrous metal items as specified in the appropriate sections of Division 9-Finishes.

05010.3.4 DUCTWORK

05010.3.4.1 DESIGN AND FABRICATION - Ducts shall be fabricated of aluminum or galvanized steel sheets with gauges of sheet metal, joint types, reinforcing, bracing, supporting, fabricating, installing, and other requirements in accordance with Duct Manual and Sheet Metal Construction for Ventilating and Air Conditioning Systems of the Sheet Metal and Air Conditioning Contractors National Association, Inc. Ducts shall be designed for the appropriate pressure type as shown in the above mentioned Duct Manual. Details on the Plans in some cases call for sheet metal thicknesses greater than called for in the Duct manual. Sheet metal shall conform to whichever requirement calls for the greater thickness. Aluminum ducting shall be not less than 0.063 inches thick.

05010.3.4.2 HANGERS - Ducts shall be supported on both sides at all changes in direction and at not greater than eight foot intervals by suitable hangers as specified herein or as detailed on the Plans. For galvanized ducting, hangers for ducts 12-inch by 24-inch or smaller shall be galvanized sheet metal straps not lighter than 18-gauge by one inch secured to the structure by one 5/16-inch bolt and to the duct by not less than two No. 10 sheet metal screws or 3/16-inch stove bolts. Hangers for ducts larger than 12-inch by 24-inch shall be galvanized steel straps or rods not less than 0.13 square inches in net cross section, secured to the structure by a Grinnell Figure 152, Size 2, concrete insert, or approved equal, and to a duct pocket or reinforcing angle by two 1/4-inch stove bolts. For aluminum ducting, supports shall be equivalent to supports for galvanized ducting except that all fasteners, fittings, and shafting shall be stainless steel.

05010.3.4.3 FLEXIBLE CONNECTIONS - Where blowers or equipment containing blowers or other machine elements, which may cause vibration, are connected to ducts or housing, such connections shall be by means of flexible connections. These flexible connections shall be airtight at the pressures encountered and be flame proof and water proof. The flexible material shall be equivalent to 14 ounce canvas.

05010.4 METHOD OF MEASUREMENT

Not used.

05010.5 BASIS OF PAYMENT

Not used.

05050.1 DESCRIPTION

This section covers a generic list of miscellaneous metals specifications.

05050.1.1 RELATED WORK

Not used.

05050.1.2 SUBMITTALS

Not used.

05050.1.3 DEFINITIONS

Not used.

05050.2 MATERIALS

05050.2.1 LADDERS AND METAL STAIRS

All ladders shall be safety ladders conforming to OSHA standards. All ladders and stairways supplied to the project shall be of one manufacturer. All stair and ladder wells shall be adequately guarded, and all stairs shall have handrails as specified or shown on the Plans.

Ladders shall be secured to the supporting surface by bent plate chips providing not less than 7 inches between the supporting surface and center of rungs. If exit from the ladder is forward, over the top rung, side rails shall be extended not less than 3-feet-3 inches above, and returned to the landing. If exit from the ladder is to the side, the ladder shall extend not less than 5-feet 6-inches above the landing and be rigidly secured at the top.

05050.2.2 ALUMINUM LADDERS

Aluminum ladders shall be made of 6063-T5-aluminum alloy, of welding construction. Rungs shall be not less than 1-inch square bar with 1/8-inch grooves in the top and redivided edges. Side rails shall be no lighter than 3 inches by 3/8 inches. Ladders shall be of the size, shape, location, and details indicated on the Plans. Ladders greater than 20 feet in height shall have standard ladder cages designed in accordance with State and OSHA requirements. All aluminum surfaces, which will be in contact with concrete, shall be coated as specified in Division 9.

05050.2.3 ALUMINUM STAIRWAYS

Aluminum stairways shall be fabricated and installed as shown on the Plans. Stairway stringers shall be fabricated of aluminum alloy 6061-T6. Treads shall be aluminum as specified below. Handrail shall be fabricated of aluminum pipe as specified under aluminum handrail.

Stair treads shall be aluminum of the sizes called for on the Plans, and shall be of the same type and make as called for under GATING. All fasteners shall be of Type 304 or 316 stainless steel.

Stair treads shall be furnished with cast abrasive type safety nosing.

05050.2.4 ARCHITECTURAL AND MISCELLANEOUS SHEET METAL

Sheet metal flashing and counterflashing shall be installed as indicated on the Plans. Galvanized steel or anodized aluminum flashing shall be used when indicated and specified on the Plans.

Unless otherwise indicated flashing shall be 0.025-inches thick. The aluminum flashing shall receive a 215-R1 anodic finish after fabrication as indicated on the Plans. Exposed edges shall be folded back 1/2-inch to provide stiffness. Except as otherwise indicated and specified on the Plans, counterflash shall be provided over all base flashings.

Unless specifically noted, galvanized steel flashing shall be used in contact with structural steel and anodized aluminum flashing shall be used in contact with structural aluminum. This shall be done to protect against dissimilar metal action.

Surfaces to which sheet metal is to be applied shall be even, smooth, round, thoroughly clean and dry, and free from all defects that might affect the application. All cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed under this section. All accessories or other items essential to the completeness of this sheet metal installation, though not specifically shown or specified, shall also be provided under this section. Nails, screws, and bolts shall be of the types best suited for the intended purpose and shall be of a composition that will not support galvanic action in the installation. Where sheet metal abuts into adjacent materials, the juncture shall be executed in a manner satisfactory to the Engineer.

Sheet metal items not covered elsewhere shall be as indicated on the Drawings and as required to provide a watertight installation. Formed sheet metal for metal covered work shall accurately reproduce the detail and design shown and profiles, bends, and intersections shall be sharp, even, and true.

05050.2.5 ALUMINUM SHEET METAL WORK

Except as otherwise specified or indicated on the Plans, sheet aluminum shall be alloy 5005-H14 conforming to the requirements of ASTM B 209 and shall be not less than 0.025 inch in thickness and extruded aluminum shall be 6063-T42.

05050.2.6 MISCELLANEOUS STRUCTURAL STEEL

Miscellaneous steel items not specified herein shall be as shown on the Plans or specified elsewhere and shall be fabricated and installed in accordance with the best practices of the trade.

05050.2.7 LINTELS

Lintels for masonry construction shall be structural steel beams or angles, fabricated as indicated on the Plans.

05050.2.8 SUBMERGED ASSEMBLY BOLTS

Assembly bolts for wood baffles, collectors, and other assemblies in areas where stainless steel anchor bolts would be required shall be stainless steel bolts Type 304 or 316.

05050.2.9 ANCHOR BOLTS AND INSERTS

Wherever feasible, anchor bolts shall be cast in place when concrete is placed.

All anchor bolts and concrete anchors embedded in concrete shall be accurately spaced with bolts truly normal to the surfaces from which they project. Type 304 or Type 316 stainless steel anchor bolts and nuts shall be used under these circumstances:

- Any time they are submerged in water.

- In the case of structures customarily containing water, placed in walls, ceilings, or overheads, even if above water level.
- In the dry side of water bearing walls.
- Where securing aluminum to steel or concrete.

Anchor bolts not required by above conditions to be of stainless steel, may be of carbon steel conforming to ASTM A 307 or ASTM A 36. Carbon steel anchor bolts in the following locations shall be hot-dip galvanized.

- Anchor bolts exposed to the weather.
- In electrical manholes or pull boxes.
- In tunnels, passageways, galleries, vaults, or rooms below grade or enclosed in part by water bearing walls.

In anchoring machinery bases subject to heavy vibration, two nuts shall be used, one serving as a locknut. In all cases where steel anchor bolts are used, a liberal coating of nonoxidizing wax shall be applied to the threads before screwing on nuts.

All bolts, when indicated for future use, shall be first coated thoroughly with nonoxidizing wax, followed by turning nuts down to the full depth of thread. Exposed thread shall then be neatly wrapped with a waterproof polyvinyl tape.

05050.2.10 INSTALLATION

Anchor bolts shall be embedded not less than 12 diameters. Where shown on the Plans, anchor bolts shall be set in metal sleeves having an inside diameter approximately 3 times the bolt diameter and not less than 12-bolt diameters in length. Sleeves shall be filled with grout when the machine or other equipment is grouted.

05050.2.11 CONCRETE ANCHORS

Concrete anchors, where indicated on the Plans or specified, shall mean drilled in place anchors with integral anchor bolts. Concrete anchors shall be Phillips "Wedge Anchors" with integral anchor bolts, or Expansion Products Company "Wej-It" concrete anchors with integral anchor bolts, or approved equal.

The material of each concrete anchor, including its integral anchor bolt, shall be the same material as would be required, under these Specifications, for anchor bolts in the same location that the concrete anchor is to be used.

Concrete anchors shall have the following minimum embedment lengths:

EMBEDMENT OF CONCRETE ANCHORS

Size	Embedment Length
3/8"	1-1/2"
½"	2-1/4"
5/8"	2-3/4"
¾"	3-1/4"

If Wej-It expansion anchors are used they shall have the following minimum embedment length:

WEJ-IT ANCHORS

Size	Embedment Length
¼"	1-1/2"
½"	5"
5/8"	5"
¾"	5"

Anchor bolts, of the same material and size as required for the specified concrete anchors, may be cast in the concrete in lieu of using concrete anchors. Embedment of bolts in concrete shall be not less than 12-bolt diameter plus a standard hook.

No cast iron, lead cinch, or slug-in anchors will be permitted for use.

05050.2.12 MISCELLANEOUS CAST IRON

All castings shall be tough, gray iron, free from cracks, holes, swells, and cold shuts, and be of workmanlike finish, and shall conform to the Standard Details and with the ASTM Specification Designation A 48, Class 40 B. The quality shall be such that a blow from a hammer will produce an indentation on a rectangular edge of the casting without flaking the metal. Before leaving the foundry, all castings shall be thoroughly cleaned and subjected to a hammer inspection, after which they shall receive a coating of coal-tar pitch varnish in such a manner as to form a firm, tenacious coating.

05050.2.13 MANHOLE FRAMES AND COVERS

Manhole frames and covers shall be made from a superior quality gray iron, conforming to the requirements of ASTM A 159, Class G3000, or ASTM A 48, Class 30-B. Frames and covers shall have horizontal and vertical bearing surfaces machined to fit neatly, and the cover shall bear firmly in the frame without rocking and shall be easily removable. Frames and covers shall be heavy-duty traffic type designed for H-20 loading and shall have a combined set weight of at least 265 pounds.

Frames shall have a clear inside opening of 24 inches diameter and shall be of the bottom flange type. Frame height shall be approximately 4½" and bottom flange outside diameter shall be approximately 32 inches.

Covers shall have a skid resistant grid pattern design as recommended ASTM publication STP326.

The elevations at which manhole frames and covers are to be set shall conform to the requirements set forth on the Plans, but in all cases shall be governed by the Engineer in the field. Where the cover is in existing pavement or in the traveled way of the existing road shoulder, it is to be placed flush with the existing surface. Where the structure is outside the limits of the traveled shoulder but not in the roadside ditch, it should be placed 1/10 foot or more above the existing ground surface. Where the manhole cover falls in the existing roadside ditch or right of way, it is to be placed approximately 1-1/2 feet above the existing ground surface or as directed by the Engineer. Manhole frames shall be set at the required grade and shall be securely attached to the top precast manhole shaft unit. After the frames are securely set in the place provided herein, covers shall be installed and all necessary cleaning and scraping of foreign materials from the frames and covers shall be accomplished to ensure a fine satisfactory fit. All costs of setting and securing manhole frame and cover sets in place as herein provided, including all necessary concrete work shall be considered as included in applicable contract unit prices and no additional allowance will be made therefor.

Cast lettering on manhole covers shall be as shown on the Plans. Shop drawings of all manhole rings and covers shall be submitted to the Engineer.

05050.2.14 CAST IRON PRESSURE MANHOLE FRAME AND COVER

The Contractor shall furnish and install, ready for use as indicated on the Plans and as specified herein, rectangular pressure manholes and covers. Each pressure manhole shall have a clear opening of 18" X 30". The pressure plate shall be flat on top and shall not be less than 1/2 inch thick steel and fastened with 316 stainless steel studs and stainless steel nuts. A 1/8-inch thick neoprene gasket shall be supplied between the frame and pressure plate. Lifting shall be provided with a watertight pickhole. The frame shall be a seal-type with flanges at the base and at the top.

05050.2.15 MISCELLANEOUS ALUMINUM

Structural and other metal items fabricated from aluminum, not covered separately herein shall be fabricated in accordance with the best practices of the trade and shall be field assembled by riveting or bolting with no welding or flame cutting permitted except as approved by the Engineer.

05050.2.16 ALUMINUM STAIR NOSING

Stair nosings shall be installed on all treads of all concrete stairs including the top tread of the upper slab. Stair nosings shall be aluminum abrasive cast nosings with aluminum oxide granules integrally cast into the metal forming a permanent nonslip long wearing surface. The nosings shall be Type 101 Stair Tread by Wooster Products, Inc., Spruce Street, Wooster, Ohio 44691, Type A stair treads by American Abrasive Metals Company, or approved equal. The treads shall have integrally cast anchors. Stair nosings shall be cast in fresh concrete and shall be flush with the tread and riser faces. Stair nosing shall be coated with zinc chromate primer in accordance with the provisions of Division 9. Screws shall be 304 or 316 stainless steel.

05050.2.17 MANHOLE STEPS

Manhole steps shall consist of 3/4-inch diameter stainless steel or polyethylene rungs. Rungs shall extend 7-inches from the face of the wall to which they are anchored and shall have a minimum clear width of 16-inches. Rungs shall be designed such that the foot cannot slide off the end. Distance between rungs shall be 12-inches. Rungs shall be hook anchored into walls a minimum of 6-inches.

05050.3 CONSTRUCTION REQUIREMENTS

Not used.

05050.4 METHOD OF MEASUREMENT

Not used.

05050.5 BASIS OF PAYMENT

Not used

05100.1 DESCRIPTION

05100.1.1 Includes furnishing and installing galvanized steel, extruded aluminum, or fiberglass bar grating for commercial or industrial floors and walk ways as shown on the Drawings an in accordance with the requirements described herein.

05100.1.2 RELATED WORK

Not used.

05100.1.3 SUBMITTALS

The Contractor shall provide complete information, which includes shop drawings for fabrication and erection of all work, parts lists, fabrication details, loading tables, anchor details, and manufacturer's installation instructions and details in accordance with the requirements of Section 01300.

With regard to 05100.2.6 – Slip Resistant Surfaces, below, evidence of compliance with the requirements stated there shall be furnished from the grating manufacturer to the Engineer at the time of delivery of the gratings to the Project site.

05100.1.4 DEFINITIONS

Not used.

05100.2 MATERIALS

05100.2.1 GENERAL GRATING REQUIREMENTS

Grating shall be of such bar size and spacing that, as determined by the manufacturer, the grating will support a uniform loading of 180 pounds per square foot on the entire area of the grating, using an extreme fiber stress of not more than 10,000 pounds per square inch. The maximum deflection under this loading will not be more than 1/240 of the clear span of the grating. The spacing of the main grating bars shall not be more than 1-1/8 inches clear between bars. Crossbars shall be at right angles to the main bearing bars, and center to center spacing shall not exceed 4¼ inches. Ends of grating and cutouts shall be banded. Grating shall be of the thickness shown on Drawings or as required by these Specifications. All grating supplied to the project shall be by one manufacturer.

05100.2.2 STEEL BAR GRATING

Shall be machine-welded, galvanized carbon steel bearing bars and cross bars. Bearing bars for steel grating shall be not less than 1-1/2 inches in depth, unless directed otherwise by the Engineer. Spacing of bearing bars and cross bars shall not be less than those required in 05100.1.1.1 above. Span length of the bearing bars shall be in accordance with the information shown on the Drawings. The grating shall in all cases, meet the load and deflection requirements of 05100.1.1.1.

05100.2.3 ALUMINUM GRATING

Shall be I-bar or rectangular bar type grating with bearing bars and cross bars locked together by a swaging process. Bearing bars for aluminum grating shall be not less than 2 inches in depth, unless shown otherwise on the Drawings, or unless directed otherwise by the Engineer. Spacing of bearing bars and crossbars shall be as required in 05100.1.1.1 above. Span length of the

bearing bars shall be in accordance with the information shown on the Drawings. The grating shall in all cases, meet the load and deflection requirements of 05100.1.1.1.

Aluminum grating shall be supported on aluminum shelf angles cast in the concrete as indicated on the Drawings. Gratings, shelf angles, anchors, etc. shall be of 6061-T6 or 6063-T6 aluminum alloy, except that cross bars may be of 6063-T5 aluminum alloy. All surfaces of shelf angles, anchors, etc. to be in contract with concrete shall be coated as specified under Division 9.

05100.2.4 FIBERGLASS GRATING

Shall be constructed of fiberglass strands set in thermoset plastic in a one-piece mold. Glass content shall not exceed more than 35 per-cent by weight. The resin shall be an opaque, fire retardant polyester or vinyl material with a UL classification. The color and mesh pattern shall be indicted on the Drawings. Bearing bars for fiberglass grating shall be not less than 3 inches in depth, unless directed otherwise by the Engineer. Spacing of bearing bars and cross bars shall be the manufacturer's standards, but load capacity and deflection shall meet all requirements of 05100.1.1.1 above. Span length of the bearing bars shall be in accordance with the information shown on the Drawings.

05100.2.5 FLOOR PLATE

Shall be a commercial grade of hot-dipped, galvanized carbon steel or aluminum plating with a raised pattern of surface projections to resist slippage of foot traffic. The size, thickness, span length and pattern configuration shall be as shown on the Drawings but, in no case shall the thickness be less than ¼-inch.

05100.2.6 CAST IRON GRATING

Shall be cast gray iron meeting the requirements of ASTM 48-93, Class 35B of the type and configuration shown on the Drawings. Castings shall be of uniform quality and free from blow holes, smooth and cleaned by shot-blasting. The size, minimum weight, spacing and span length of the grating sections shall be in accordance with the requirements indicated on the Drawings. Gratings located in areas subject to vehicular traffic shall be capable of sustaining standard highway H-20 loads. Bearing surfaces between grating and supporting cast iron frames shall be machined to allow full contact between the grating and fence.

05100.2.7 SLIP RESISTANT SURFACES

When slip resistant surfaces are required by the Drawings or these Specifications, such surfaces shall conform to all applicable OSHA standards and to USDA/FDA requirements for the food and drug industry, when applicable.

05100.3 CONSTRUCTION REQUIREMENTS

05100.3.1 PREPARATION

The Contractor shall carefully prepare the supporting structure to provide a neat fit and unobstructed walking surface in accordance with the Drawings. A clearance of 1/4-inch shall be provided for grating sections to provide easy removal and minimal movement when tread on. Openings for piping or other obtrusions shall be reinforced to support bearing components of the grating.

05100.3.2 Gratings shall be furnished and installed with appropriate clips and/or fasteners as recommended by the grating manufacturer. Supporting frames for grating shall be fabricated from materials which will not contribute to the corrosion or deterioration of the grating and which will provide

uniform support to the grating sections. Grating frames shall be designed to be removable and/or replaceable unless shown otherwise on the Drawings.

05100.3.3 Grating located in areas subject to foot and vehicular traffic shall have opening spaces sufficiently small as to not allow entrapment of bicycle or wheelchair wheels.

05100.3.4 Support for grating sections shall be constructed in full compliance with the recommendations of the grating manufacturer. Openings for piping or other obtrusions shall be properly reinforced to provide support of the bearing components of the grating section.

Except as otherwise specified or shown on the plans, grating shall be supported on shelf angles cast in the concrete as indicated on the plans. All surfaces of shelf angles, rebates, anchors, etc. to be in contact with concrete shall be coated as specified under Division 9.

05100.3.5 The clear opening space for grating section shall provide sufficient space for easy removal of sections; however, it shall not be oversized to allow excessive movement of the sections. Unless otherwise indicated, this clearance space shall be ¼-inch between grating sections and supporting frames. The top surfaces of grating sections adjacent to each other shall be in the same plane.

05100.4 METHOD OF MEASUREMENT

Separate measurement of the floor will not be made when the material is installed as a component of a building or structure listed in the Bid Schedule.

05100.5 BASIS OF PAYMENT

Separate payment will not be made for floor grating included in the measurement of a building or structure in which it is installed.

05500.1 DESCRIPTION

The Contractor shall furnish and install flexible metal beam guardrails, posts, and transitions as shown on the Drawings.

05500.1.1 RELATED WORK

Not used.

05500.1.2 SUBMITTALS

The Contractor shall provide descriptive information, showing beam guardrail configuration and material type, wood species and type of treatment of posts, and material supplier's name/s and address/s in accordance with the requirements of Section 01300.

05500.1.3 DEFINITIONS

Not used.

05500.2 MATERIALS

05500.2.1 GUARDRAIL

Beam Guardrail shall be Class A, Type 1, galvanized steel W-Beam guardrail, including bolts and fittings, all of which meet the requirements of AASHTO M-180.

05500.2.2 POSTS

Wood posts and blocks shall be rough sawn, Grade No. 1 or better, Douglas Fir, Larch, Lodgepole Pine, or Ponderosa Pine pressure treated wood sections of the size shown on the Drawings. Treatment shall be pentachlorophenol or ammoniac copper arsenate or chromate copper arsenate, Type A or B in accordance with AASHTO M-133.

05500.2.3 TRANSITION SECTIONS

Guardrail transition elements shall be composed of steel and wood materials of the configuration shown on the Drawings, and conforming to the requirements shown above for wood posts and beam guardrail.

05500.3 CONSTRUCTION REQUIREMENTS

05500.3.1 PREPARATION

Guardrail shall not be installed until the surface on which it is to be installed has been finish graded. If over-excavation of postholes occurs, fill excess depth with mechanically compacted backfill before the posts are set.

05500.3.2 SETTING POSTS

Posts shall be set to achieve uniform alignment. The space around the posts shall be backfilled with selected earth material free of rocks larger than 2 inches in layers not greater than 4 inches and compacted with mechanical compaction equipment. The posthole shall be backfilled to grade and additional granular borrow shall be provided if needed to fill the hole.

05500.3.3 INSTALLATION OF RAILS AND TRANSITION SECTIONS

The Contractor shall curve designated rail sections appropriately before installing them. The rail elements shall be lapped so exposed ends will not face approaching traffic. Transition elements shall be installed according to the Drawings and the manufacturer's installation instructions. The area beneath the newly installed guardrail shall be hand raked to present a clean and uniform appearance to complete the installation.

05500.3.4 REMOVAL OF GUARDRAIL AND DISOSAL OF MATERIAL

When removal of existing guardrail is called for in the Bid Schedule, The Contractor shall remove and dispose of the resulting debris at a public waste disposal area and grade the area before starting any new installation of guardrail. All surplus material shall be disposed of at a public waste disposal site or other area approved by the Engineer.

05500.4 METHOD OF MEASUREMENT

05500.4.1 BEAM GUARDRAIL

Beam guardrail shall be measured using a tape measure or other accurate measuring device to determine the total number of lineal feet measured along the face of the railing to the post center where any transition section begins.

05500.4.2 TRANSITION SECTIONS

Measurement of Transition Sections shall be made by counting the number of each section of the type shown in the Bid Schedule.

05500.4.3 REMOVAL OF GUARDRAIL

Removal of guardrail shall be measured using a tape measure or other accurate measuring device to determine the total number of lineal feet measured along the face of the railing, including any transition sections.

05500.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price shown in the Bid Schedule for:

PAY ITEM	UNIT
Beam Guardrail	Lineal Foot
(*Type*) Transition Section	Each
Removal of Beam Guardrail	Lineal Foot

05570.1 DESCRIPTION

This section covers furnishing and installing galvanized iron or welded steel pipe posts filled and set in concrete at designated locations shown on the Drawings and in accordance with the requirements described herein.

05570.1.1 RELATED WORK

Not used.

05570.1.2 SUBMITTALS

Not used.

05570.1.3 DEFINITIONS

Not used.

05570.2 MATERIALS

05570.2.1 POSTS

Posts shall consist of Schedule 40, galvanized pipe or welded carbon steel pipe with 3/16-inch (min.) wall thickness. Pipes shall extend 48-inches above the driving surface in which they are set and 36-inches below the driving surface. Diameter shall be as shown on the drawings.

05570.2.2 CONCRETE

Concrete installed in the post interior and surrounding the post shall be Class 2000 Portland cement concrete meeting the requirements of Section 03050 of these Specifications. Concrete shall be premixed before placing.

05570.3 CONSTRUCTION REQUIREMENTS

The Contractor shall carefully locate the position of the bumper post from information provided on the Drawings and excavate a hole of sufficient diameter and depth to provide at least 4-inches of coverage when filled with concrete.

The posts shall be set plumb and in a position that will not obstruct entry into any doorway to be protected by the post. Following the setting and filling of the post with concrete, a galvanized iron cap will be screwed on the galvanized pipe and/or a steel cap will be welded tightly to the welded steel post and the post will then be cleaned and painted in accordance with Section 09910 of these Specifications with red enamel.

05570.4 METHOD OF MEASUREMENT

Separate measurement of the bumper posts will not be made when they are installed as a component of a building or structure listed in the Bid Schedule. Measurement of the posts will be included with the building or structure which it serves.

05570.5 BASIS OF PAYMENT

Separate payment will not be made for bumper posts included in the measurement of a building or structure in which it is installed.

DIVISION 6

WOOD AND PLASTICS

SUNRISE
ENGINEERING

06100.1 DESCRIPTION

Carpentry shall include furnishing and installing wood, metal, and other materials typically used for wood framed buildings or building components.

06100.1.1 RELATED WORK

Section 08110 – Doors, Frames, and Hardware
Section 08210 - Metal Windows
Section 09910 - Painting

06100.1.2 SUBMITTALS

The Contractor shall submit information which indicates size, grade and source of lumber materials for review and approval by the Engineer. Information which describes materials, thickness, size, model number, manufacturer's name, etc. shall be submitted for review for all other materials, including its fasteners, required to complete the building or its component as shown on the Drawings and described herein. All such information and/or materials shall be submitted in accordance with Section 01300 of these Specifications.

06100.1.3 DEFINITIONS

Not used.

06100.2 MATERIALS

06100.2.1 LUMBER

Lumber materials shall be graded No. 2 or better, Douglas Fir, Pine, or Hemlock and shall be free of warping which will affect the alignment of the structural component in which it is installed. Lumber materials which contain signs of rot, fungus, or termite damage will be rejected. Wood materials installed in direct contact with soils, earth materials or concrete floors or footings shall be pressure treated or foundation grade Redwood.

06100.2.2 LAMINATED STRUCTURES

Laminated structural joists, beams and girders shall be of the size and strength capacity shown on the Drawings and shall be manufactured in accordance with the standards of the American Institute of Timber Construction.

06100.2.3 PLYWOOD

Plywood shall be not less than three ply and of the grade and thickness shown on the Drawings, and manufactured in accordance with the standards of the American Plywood Association.

06100.2.4 EXTERIOR FINISH

Wood materials used for exterior finishing shall be solid wood or exterior plywood or plywood siding of the type and grades shown on the Drawings.

06100.2.5 INTERIOR FINISH

Wood materials used for painted interior finishing shall be finger jointed grade ("Paint Grade") pine. Materials used for interior finishing when coated to show a natural wood grain shall be clear

grade solid wood or veneered plywood of the species, type and grade shown on the Drawings. Pressed wood or simulated wood materials will not be acceptable for wood cabinets or naturally finished wood trim.

06100.2.6 METAL FRAMING

Metal framing shall consist of galvanized steel sheet of the gage and dimensions shown on the Drawings and manufactured in accordance with the standards prescribed in the Uniform Building Code. Wood may be substituted for metal, or metal may be substituted for wood framing. However, all framing installed within a building must be either wood or metal, unless shown otherwise on the Drawings.

06100.2.7 WALLBOARD

All wallboard shall be of the size and configuration indicated on the Drawings and of a type consistent with good building practice. Wallboard shall conform to the applicable requirements of the most recent edition of the Uniform Building Code (UBC), Sections 2511, 2512, and 2513, as appropriate, together with associated tables therein.

06100.2.8 HARDWARE

All fasteners, hardware and fittings shall be of the size and configuration indicated on the Drawings and consistent with good building practice. Metal hardware and fittings shall be of a good quality, industrial grade, manufactured for heavy-duty service.

Fasteners shall be as required by the UBC as mentioned in 06100.2.7, above. All metal fasteners (nails, clips, etc.) used on members exposed to wet or exterior conditions shall be galvanized steel, stainless steel or aluminum. Screws for fastening gypsum wallboard shall be corrosion resistant steel.

06100.3 CONSTRUCTION REQUIREMENTS

06100.3.1 CARPENTRY STANDARDS

All carpentry work provided in this Contract shall be performed in accordance with the applicable requirements of the UBC, its current amendments, and any building requirement enforced by any local building authority.

In general, all carpentry shall be performed in a manner that exhibits good quality. All joints shall be cut to fit tight. All load bearing member joints shall be cut and fit to provide full bearing and load distributing capability.

06100.3.2 WALLBOARD

Installation of wallboard shall comply with the applicable requirements of UBC Sections 2511, 2512, and 2513. Fastener placement shall conform to Table 25G of the UBC as applicable.

Unless indicated otherwise in these Specifications, in addition to fastening with steel screws, all gypsum wallboard shall be glued at all contacts with framing.

06100.3.3 WOOD PLATES

Wood plates on concrete or masonry walls shall be installed to form a level plane. When necessary, cement grouting will be used to ensure full bedding of the plates.

06100.3.4 CABINETS

Cabinets shall be furnished and installed in conformity to the requirements for "custom" grade as defined by the Architectural Woodwork Institute standards. Shelving in cabinets shall be manufactured so as to be adjustable.

06100.3.5 EXPOSED PLYWOOD EDGES

Exposed edges of plywood paneling around door or vent openings, or at corners, shall be concealed with wood casing. Concealing shall be accomplished with 1/4-inch (minimum thickness) moldings unless shown otherwise on the Drawings.

06100.3.6 VINYL BASE

When not shown otherwise, 2-inch (minimum) width vinyl base shall be installed to close the joint between the floor and wall. Such base material shall be installed by securing with a waterproof adhesive to the wall.

06100.4 METHOD OF MEASUREMENT

Separate measurement will not be made for carpentry. When carpentry is required, its measurement shall be included with the measurement for the building or structure shown in the Bid Schedule.

06100.5 BASIS OF PAYMENT

Payment for carpentry shall be included in the payment for the building or structure as shown in the Bid Schedule.

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SUNRISE
ENGINEERING

07210.1 GENERAL

07210.1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

07210.1.2 SUMMARY

A. This Section includes the following:

1. Foundation wall insulation (supporting backfill).
2. Cavity wall insulation.
3. Concealed building insulation.
4. Metal building insulation system and vapor barrier exposed to plenum areas.
5. Perimeter fire-containment systems - fire prevention
6. Vapor retarders.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete."
2. Division 4 Section "Unit Masonry Assemblies" for insulation installed in cavity walls.

07210.1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: Full-size units for each type of exposed insulation indicated.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

D. Research/Evaluation Reports: For foam-plastic insulation.

07210.1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.

2. Fire-Resistance Ratings: ASTM E 119.

3. Combustion Characteristics: ASTM E 136.

07210.1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.

3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

07210.2 PRODUCTS

07210.2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Extruded-Polystyrene Board Insulation:

a. DiversiFoam Products.
b. Dow Chemical Company.
c. Owens Coming.
d. Tenneco Building Products.
e. Engineer approved equal.

2. Glass-Fiber Insulation:

a. CertainTeed Corporation.
b. Johns Manville Corporation.
c. Knauf Fiber Glass.
d. Owens Coming.

3. Metal Building Roof and Sidewall Systems:

a. Thermal Design, Inc.
b. "Simple Saver Systems" 1-800-255-0776.
c. Engineer approved equal.

4. Perimeter Fire-Containment Systems:

a. United States Gypsum Co.
b. Engineer approved equal.

07210.2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively:

1. Type IV, 1.60 lb/cu. ft. (26 kg/cu. m), unless otherwise indicated.

C. Unfaced Mineral-Fiber Blanket Insulation (for concealed wall applications): ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

D. Unfaced Mineral-Fiber Blanket for application at metal purlin/roofing and sidewall girt systems: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass, slag wood or rock wool with maximum flame-spread and smoke-developed indices of 25 and 50 respectively, passing ASTM E 136 for combustion characteristics.

1. Nominal 3-1/2" batt for application directly under metal roofing and siding system.

2. Nominal 6" batt or thicker for application within the roof purlin spacing concealed by proprietary system vapor barrier.

3. Completed system R-value based on 4'-9" member and wall girt spacing of R-30.

07210.2.3 PERIMETER FIRE-CONTAINMENT SYSTEMS

Where indicated for gaps between the perimeter edge of fire-resistance-rated floor and roof/ceiling assemblies, provide a perimeter fire-containment system with the fire-test-response characteristics indicated, as determined by testing identical systems per UBC Standard 26-9 and UL 20709 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Products: Subject to compliance with requirements provide

a. USG Thermafiber SAFB
b. Engineer approved equal.

07210.2.4 VAPOR RETARDERS

A. Products: Subject to compliance with requirements, provide one of the following:

B. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum vapor transmission rate of 0.13 perm (7.5 ngfPa x s x sq. m).

1. Application: concealed by gypsum wallboard

C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

D. Heavy Duty Fire Retarder, Reinforced Polyethylene Vapor Retarder (nominal 8 mil thickness): 2 outer layers of colored polyethylene film laminated to a woven HDPE 900 denier Skrim and weighing not less than 31 lb./1000 sf (14.1 kg/i 00 sq m) with a maximum vapor transmission rating of 0.02 US perms (11.44 ng/Pa x s x sq m), and a flame-spread and smoke developed indices of not more than 25 and 50 respectively.

1. Application: at interior side of all metal building roofs and sidewalls.

2. Custom sizes: match structural bay widths up to 5000 sf per piece.

3. Color: Super White

07210.2.5 AUXILIARY INSULATING MATERIALS

Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

07210.2.6 INSULATION FASTENERS

Products: Subject to compliance with requirements, provide one of the following:

1. Insulation-Retaining Strapping: Continuous painted steel strapping formed from 0.0 16-inch (0.41-mm) thick galvanized steel sheet, sized as required to hold metal building insulation and vapor retarded securely in place, but not less than 1 inch (25.3 mm) in width.

2. Strap Anchors: Metal roof insulation system manufacturer approved painted self-drilling steel fasteners.

07210.3 EXECUTION

07210.3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for
Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

07210.3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

B. Close off openings in cavities receiving poured-in-place insulation to prevent escape of insulation. Provide bronze or stainless-steel screens (inside) where openings must be maintained for drainage or ventilation.

07210.3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer’s written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. At metal roof systems and sidewall systems apply multiple layers of insulation to provide complete fill of purlin/girt depth under slight compression.

E. At walls apply multiple layers of insulation to produce thickness indicated, and as required to make up total thickness.

07210.3.4 INSTALLATION OF PERIMETER INSULATION

A. On vertical surfaces, set units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line; 36 inches (915 mm) total piece size.

B. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection board. Set in adhesive according to insulation manufacturer's written instructions.

C. Protect top surface of horizontal insulation from damage during concrete work by applying protection board.

07210.3.5 INSTALLATION OF CAVITY WALL INSULATION

On units of plastic insulation, install small pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, as recommended by manufacturer. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 4 Section "Unit Masonry Assemblies."

2. At wall assemblies indicating metal zee framing, adhesive can be deleted.

07210.3.6 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically.

D. Place loose-fill insulation into spaces and onto surfaces as shown, either by pouring or by machine blowing to comply with ASTM C 1015. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

1. For cellulosic loose-fill insulation, comply with the Cellulose Insulation Manufacturers Association's Special Report #3, "Standard Practice for Installing Cellulose Insulation."

E. Stuff glass-fiber, loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

07210.3.7 INSTALLATION OF PERIMETER FIRE CONTAINMENT SYSTEMS

A. Install perimeter fire-containment blanket systems to completely fill voids in fire rated construction. Cut and piece material as required to comply with manufacturer's recommended installation procedures.

07210.3.8 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated and metal strap systems at roof purlins. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs or one roof purlin bay spacing. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.

C. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to vapor-retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

D. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.

E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

F. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

07210.3.9 PROTECTION

Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

07210.4 METHOD OF MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

07210.5 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

07500.1 DESCRIPTION

Includes furnishing and installing lightweight fiberglass or foam insulation in buildings or enclosures as shown on the Drawings an in accordance with the requirements described herein.

07500.1.1 RELATED WORK

Not used.

07500.1.2 SUBMITTALS

The Contractor shall provide complete information which includes complete product description and manufacturer's installation instructions in accordance with the requirements of Section 01300.

07500.1.3 DEFINITIONS

Not used.

07500.2 MATERIALS

07500.2.1 FOAM

Foam insulation materials shall be Styrofoam brand insulation board, or approved equal, with a thermal resistance rating (R-Value) per inch of five (5) and a capability of being submerged in water and not absorbing more than 0.1% water by volume.

07500.2.2 FIBER

Fiber insulation materials shall consist of long, resilient glass fibers bonded with a thermosetting resin in batts faced with foil and kraft paper facing which enables the product to carry a fire hazard classification rating of 25/50 or less per ASTM E 84. Unless called for otherwise, the thermal resistance and material shall be Corning, 6”, R-19.

07500.3 CONSTRUCTION REQUIREMENTS

The type, application and installation of either insulation material will be as shown on the Drawings.

07500.3.1 PREPARATION AND INSTALLATION

The Contractor shall carefully prepare the supporting structure to provide a neat fit for the insulation material in accordance with its manufacturer’s recommendations. Appropriate anchor devices or procedures shall be provided to retain the insulation in proper position as recommended by the manufacturer.

07500.3.2 DUCT INSTALLATION

New supply ductwork shall be insulated with 1-pound density, 1-inch thick, fiberglass blanket insulation having aluminum foil reinforced facing complete with vapor barrier. Insulation shall be secured to the sheet metal with clips and adhesive as recommended by the insulation manufacturer. Insulation shall be fitted to the duct surfaces with all joints tightly butted together and against standing seams. All joints and/or holes shall be vapor sealed using an adhesive compound as recommended by the insulation manufacturer.

07500.4 METHOD OF MEASUREMENT

Separate measurement of thermal insulation will not be made when the material is installed as a component of a building or structure listed in the Bid Schedule. Measurement will be included with the building or structure which it serves.

07500.5 BASIS OF PAYMENT

Separate payment will not be made for thermal insulation included in the measurement of a building or structure in which it is installed.

MASONRY BLOCK LOOSE FILL INSULATION — SECTION 07560

07560.1 DESCRIPTION

The Contractor shall furnish and install loose fill insulation in masonry block walls, as shown on the Drawings or as required by these Specifications.

07560.1.1 RELATED WORK

Section 03300 – Concrete Structures and Slabwork
Section 04200 – Concrete Block Masonry

07560.1.2 SUBMITTALS

The Contractor shall submit complete information, which includes complete product description and manufacturer's installation instructions in accordance with the requirements of Section 01300 of these Specifications.

07560.1.3 DEFINITIONS

Perlite – An insulation material that is an inert volcanic glass material expanded by a special heat treatment process, which results in a relatively light weight white granular material with countless small holes within its structure. Perlite will not settle in the wall, and it is non combustible with a fusion point of 2300 degrees Fahrenheit.

07560.2 MATERIALS

Loose fill insulation shall be perlite, meeting all requirements of ASTM C549, unless otherwise shown on the Drawings or required by these Specifications.

07560.3 CONSTRUCTION REQUIREMENTS

The Contractor shall install loose fill masonry block wall insulation in strict accordance with manufacturer's instructions, the Drawings and these Specifications. The perlite shall be treated with a water repellant system. Perlite loose fill insulation shall be free flowing and non-bridging when poured into masonry cavities and voids.

07560.4 METHOD OF MEASUREMENT

07560.4.1 NO MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

07560.4.2 SEPARATE MEASUREMENT

When listed as a separate item the Bid Schedule, Perlite shall be measured at the unit rate given therein.

07560.5 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

When a separate bid item is provided in the Bid Schedule, complete compensation for this accepted work shall be included in the contract unit price given in the Bid Schedule.

07620.1 DESCRIPTION

07620.1.1 SUMMARY

Section Includes

1. Parapet Coping and Cap Flashings, complete with all accessories.
2. Reglets and Miscellaneous exposed metal trim arid flashings.
3. Brick, masonry, and foundation flashings.

07620.1.2 REFERENCES

A. ASTM A *653/A 653M* - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zing-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
B. SMACNA – Architectural Sheet Metal Manual.

07620.1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01300.
B. Describe material profile, jointing pattern, jointing details, fastening methods, sealant methods, and installation details.
C. Verify Leg lengths will extend to finish material surfaces.

07620.1.4 QUALITY ASSURANCE

Qualifications

1. Applicator: Company specializing in sheet metal flashing work with three years minimum experience. Comply with SMACNA's "Architectural Sheet Metal Manual".

07620.1.5 EXTENDED WARRANTY

A. Under provisions of Section 01700.
B. Provide 20 year warranty for degradation of metal finish.

07620.1.6 MAINTENANCE - NOT USED.

07620.2 MATERIALS

07620.2.1 Zinc-coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, 690 coating designation, structural quality; 24 gage steel, shop pre-coated with Kynar 500 coating to match metal roofing.

07620.2.2 Fasteners: Stainless steel with soft neoprene washers at exposed fasteners. Finish exposed fasteners same as flashing metal.

07620.2.3 Sealant: Type specified in Section 07900. Color to match metal finish.

07620.2.4 Protective Backing Paint: Bituminous – cold applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil dry film thickness per coat.

07620.2.5 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
B. Fabricate cleats and starter strips of same material as sheet, minimum six inches wide, interlockable with sheet.

C. Form pieces in longest practical lengths.
D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
E. Form material with flat lock seam.
F. Caulk metal joints with sealant.
G. Fabricate vertical faces with bottom edge formed outward 1/2 inch and hemmed to form drip.

07620.3 EXECUTION

07620.3.1 EXAMINATION

Beginning of installation means acceptance of existing conditions.

07620.3.2 PREPARATION

Field measure site conditions prior to fabricating work.

07620.3.3 INSTALLATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install reglets true to lines and levels. Seal top of reglets with sealant.

C. Install copings and trim true to lines and levels.

D. Seal Metal Joints watertight.

E. Install all materials as recommended by the manufacturer to eliminate all irregularities, including oil canning.

07620.4 METHOD OF MEASUREMENT

07620.4.1 This work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

07620.5 BASIS OF PAYMENT

07620.5.1 Complete compensation for the accepted work outlined in this Section shall be included in other bid items.

07700.1 DESCRIPTION

This section covers furnishing and installing built-up or shingle roofing and metal roofing systems on buildings or enclosures as shown on the Drawings and in accordance with the requirements described herein.

07700.1.1 RELATED WORK

Not used.

07700.1.2 SUBMITTALS

The Contractor shall provide complete information which includes complete material description and manufacturer's installation instructions in accordance with the requirements of Section 01300.

07700.1.3 DEFINITIONS

Not used.

07700.2 MATERIALS

07700.2.1 ASPHALT CEMENT AND COATING

Asphalt cement and coating applied for bonding shall be Type I or II per ASTM D 312 with a flash point not less than 475^0 F. The material shall be heated just enough to achieve softening suitable for application while not producing an excess of fumes.

07700.2.2 FELT MEMBRANES

Shall be organic asphalt felt paper (#15 Plain 15 lb.) and heavyweight saturated organic felt paper (Heavy-duty 40 lb.).

07700.2.3 SHINGLES

Shall be organic asphalt, self-tabbing shingles with a 25 year limited warranty, Class “C” fire rating and a minimum weight of 225 pounds per square.

07700.2.4 FLASHING

Shall be 18 gage (min.) aluminum or galvanized steel sheet. Edging materials shall be aluminum or galvanized steel sheet and shall match the metal type used for the roof fascia covering, if any.

07700.2.5 NAILS

Shall be galvanized roofing nails with a minimum length of 1 1/2-inch.

07700.2.6 GRAVEL COVERING

Shall be 3/8-inch (max.) washed pea gravel.

07700.2.7 CAULKING

Shall be a good quality flexible roof sealant which can be applied under pressure with a standard hand operated caulking gun.

07700.2.8 METAL ROOFING AND RIDGE CAP

Consists of a 26-gauge spanline profile painted metal roofing and fastened with rubber washer galvanized roofing screws of sufficient length to penetrate the sheathing. Color shall be determined by the Engineer.

07700.3 CONSTRUCTION REQUIREMENTS

07700.3.1 PREPARATION

The Contractor shall carefully clean and prepare the roof surface in accordance with its manufacturer's recommendations. Roofing materials shall then be applied as follows:

07700.3.2 EDGING

Edging applied along the lower edge of the roof shall be set so that the base sheet extends over the upper edge of the edging strip to prevent any water from entering under the edging strip

07700.3.3 FLASHING

Flashing shall be installed with the upstream edges tucked under the asphalt shingles and the downstream edge always laid above the shingle layers. The upstream edge of all flashing and edges of overlapping shingles shall be caulked with a continuous strip of caulk. Flashing in valleys on the roof shall be extended at least 8-inches under the shingle layers on the sides.

07700.3.4 BUILT-UP ROOFING

Consists of a base sheet (40 LB felt membrane) laid directly on the roof sheathing and/or insulation. This sheet shall be fastened with roofing nails of sufficient length to fully penetrate the roof sheathing and placed at a spacing not to exceed 12-inches on center. Three layers of #15 plain felt paper will then be applied over the base sheet with hot asphalt cement. Following the application of the 15 lb. Felt paper, a heavy layer of asphalt coating shall then be applied and gravel shall be uniformly distributed over the surface at an application rate of 400 lbs. per 100 square feet.

07700.3.5 SHINGLED ROOFING

Consists of a 40 lb. base sheet applied directly on the roof sheathing and fastened along the edges with roofing nails of sufficient length to penetrate the sheathing. Edge nailing will be done at a spacing of not more than 8-inches on center. Following the application of the base sheet, shingles will be applied in accordance with the instructions of the manufacturer.

07700.3.6 METAL ROOFING AND RIDGE CAP

All installation and spacing of screws will be completed to manufacturer's specifications.

07700.4 METHOD OF MEASUREMENT

Separate measurement for roofing materials will not be made when the material is installed as a component of a building or structure listed in the Bid Schedule. Measurement will be included with the building or structure which it serves.

07700.5 BASIS OF PAYMENT

Separate payment will not be made for roofing materials included in the measurement of a building or structure on which it is installed.

07700.2.8 METAL ROOFING AND RIDGE CAP

Consists of a 24-gauge steel standing seam snap lock profile PVDF painted metal roofing and fastened with concealed fasteners. Width of each panel shall be approximately 16" to 18" with a standing seam height of 1.75". Color shall be determined by the Owner.

Panel shall pass UL 580 and UL 1897 testing and be capable of resisting at least 85 psf uplift.

Roofing shall also include underlayment of 30# felt, "Titanium" or equivalent underlayment as recommended by roofing manufacturer.

DIVISION 8

DOORS AND WINDOWS

SUNRISE
ENGINEERING

08110.1 DESCRIPTION

This section of the specifications covers the furnishing and installing of all doors, transoms, center panels, windows, and associated finished hardware. In general, details, door and window types and sizes are indicated on the Plans.

08110.1.1 RELATED WORK

Not used.

08110.1.2 SUBMITTALS

08110.1.2.1 SHOP DRAWINGS - Shop drawings shall be submitted to the Engineer for his approval. Shop drawings shall show all details of doors, frames, windows, and accessory items, including all details or proper anchorage to the adjacent wall construction in each case.

08110.1.2.2 DESCRIPTIVE LITERATURE - Descriptive literature which identifies the manufacturer, model numbers, materials of fabrication and sizes shall be provided in accordance with Section 01300 of these Specifications.

08110.1.2.3 MANUFACTURER'S LITERATURE - Any manufacturer's literature provided for maintaining and operating their doors and hardware shall be furnished to the Owner prior to the time of final acceptance for payment.

08110.1.2.4 STAINED SAMPLES – See 08110.2.2.4 below.

08110.1.3 DEFINITIONS

Not used.

08110.2 MATERIALS

08110.2.1 STEEL DOORS

All steel doors indicated in the Door Schedule and their pressed steel frames shall be hollow steel doors as detailed on the Plans and specified herein.

Doors and frames shall be made of prime quality, cold-rolled, pickle annealed, stretcher leveled steel, free from scale, pitting, and surface defects.

Hollow metal doors shall be 1-3/4 inches thick flush type, constructed of 2 sheets of not less than 16-gauge steel sheets formed and welded for flush pan assembly, with internal 20-gauge vertical reinforcing channels spaced not over 8 inches on centers the full height of the door. Reinforcing channels shall be uniformly spot welded to mated pans. Continuous 18-gauge stiffener channels shall be welded to faceplates top and bottom of all doors. Filler channels shall be provided at the top of exterior doors and also at the bottom of doors with thresholds to provide flush closure. All interior void spaces shall be completely filled with not less than 3-pound density rock wool or polyurethane. There shall be no visible joints on the face of the doors.

Concealed sheet or bar steel reinforcing shall be provided for mortise type hardware. Reinforcing shall be not less than the following: 9-gauge for butts; 12-gauge for locksets; and 14-gauge for surface applied hardware. Reinforcing shall be drilled and tapped to template requirements. Concealed reinforcing shall be provided for closers.

08110.2.1.1 OPENINGS

Where indicated in the Door Schedules on the Plans, doors shall be provided with glazed openings. Moldings shall be integral with and welded into the door providing 2 recessed rebates at all openings. The top and bottom interior glazing stop shall be removable and shall be flush with face sheets of door. Doors with glazed openings shall be Overly door type, or approved equal.

08110.2.1.2 ASTRAGALS

Astragals shall be provided on the active leaf of all exterior double doors and shall be a 1-3/4 inches wide, 12-gauge steel strip extended the full height of the door.

08110.2.1.3 FRAMES

Frames for hollow metal doors shall be pressed steel as indicated on the Plans. Pressed steel frames shall be constructed of not less than 16-gauge steel and shall be of the shape indicated on the plans and as required to fit the various wall construction. Frames shall be of welded unit construction assembled and welded in the shop. Welding shall be to the hairline joint with all exposed beads ground smooth. Jamb rebates shall be provided for three gray rubber door silencers. Concealed forcing of the frames for mortise hardware shall be not less than the following: 3/16-inch for butts; 12-gauge for lock strike; 14-gauge for surface applied items; and 18-gauge plaster guards over mortised hardware reinforcement. Frames shall be mortised drilled, and tapped to template requirements. Lock reinforcing units shall be supplied by finish hardware supplier. Frames in concrete shall be held in place by grout poured in keyways provided at all heads and jambs. Anchors for doorframes in masonry shall be Overly No. 111, or approved equal.

After shop assembly, doors and frames shall be cleaned thoroughly, ground smooth, and all seams along the edges of the door shall be filled flush with mineral filler. All doors and frames shall be bonderized and given one shop coat of rust inhibitive primer.

Gray rubber mutes shall not be installed until after painting, and then installation shall be deferred until as late in the job as possible, to avoid loss or damage. Before installation of the rubber mutes, the space behind the holes which are to receive the mutes shall be thoroughly cleared of any mortar or other obstructions which might prevent the mutes snap-locking into place.

08110.2.2 WOOD WALK DOORS

08110.2.2.1 DOORS - Wood doors shall be furnished and installed where shown on the Plans and as specified herein. Doors shall be flush veneered, prefinished, with a clear thermoplastic film 3 mils thick, edges sealed, and individually carton packed. Doors shall be guaranteed by the manufacturer according to the N.W.M.S. Standard Door Guarantee.

08110.2.2.2 DOORFRAMES - Doorframes, except fire door, shall be extruded anodized aluminum as indicated on the Plans. Door frames and accessories shall be color anodized as indicated on the Drawings or required in these Specifications.

08110.2.2.3 FIRE-RATED WOOD DOOR - Door shall be 1-3/4-inch, “Label B”, one-hour mineral core fire door as manufactured by Weyerhaeuser Company; Paine Lumber Co., Inc.; or approved equal. Face veneer shall be Rotary Select White Birch and the door shall bear the “Label B” Underwriter’s Laboratory designation. The door shall be installed in a UL approved frame.

08110.2.2.4 SOLID CORE DOORS - Solid core doors shall be solid particleboard core as manufactured by Weyerhauser Company; Paine Lumber Company, Inc.; or approved equal. Face veneers and edges shall be stained. Stained samples shall be submitted to the Engineer for approval prior to staining of the actual door.

08110.2.2.5 HOLLOW CORE DOORS - Door face veneers and edges shall be Rotary White Birch, and shall be Paine Lumber Co. “Rezo Type”, or approved equal.

08110.2.3 TRANSOMS AND CENTER REMOVABLE PANELS

Transoms shall be either glass or steel panel as indicated in the Door Schedule on the Plans. All transoms and center panels shall be easily removable with clips as indicated on the Plans. All center panels shall match the door in which the center panel is placed, in thickness, material, and finish unless otherwise noted in these Specifications or on the Plans.

Glass transoms shall have 1/4-inch tinted tempered plate glass and shall be shop glazed in 6063T5 extruded aluminum sashes.

Steel transoms shall match the door over which the transom is placed in thickness, material and finish. Each transom shall have a neoprene gasket between the steel back and the transom. The clip shall tighten the transom against the neoprene gasket.

08110.2.4 DOOR HARDWARE

Shall be as follows:

08110.2.4.1 PANIC BAR LATCH - All exterior doors shall be equipped with panic bar latching devices, Rim 80 Series by Sargent and Company, Apex 2000 Series by Precision or approved equal.

08110.2.4.2 DOOR CLOSURES - Doors shall be equipped with Series 351 closures as manufactured by Sargent and Company, QDC 100 Series by Stanley, or approved equal. All closures shall have hold-open features, and shall be ADA compliant.

08110.2.4.3 KNOB LATCH SET – Shall be as follows:

- Latch sets for exterior walk doors shall meet Fed. Spec. FFH-106a-161A. They shall be stainless steel unless specified otherwise on the door schedule. One latch set is required for each single door and one for the active-leaf on double doors on all exterior walk doors. Latch sets shall be locked/unlocked by key from the outside knob and pushbutton locked from the inside. Sargent 11 Line by Sargent Company, 9K Series by BEST, or approved equal.

- Latch sets for interior doors shall meet Fed. Spec. FFH-106a-161N. They shall have no locks. Knobs shall be Tulip type rasp.

08110.2.4.4 DEADLOCKING LATCH: Dead lock latches shall have a dead lock, double cylinder B252PD as manufactured by Schlage Locks, T Series by Stanley, or approved equal where shown on the door schedule.

08110.2.4.5 KEYING: Locks shall be keyed in conjunction with the existing system. Keying shall be submitted and is subject to Engineer’s approval.

08110.2.5 LOCKS

Shall be Series 11 Line by Sargent, 9K Series by BEST, or approved equal, with L stainless steel levers. Five keys shall be provided for each lock set.

08110.2.6 HINGES

Shall be full mortise, five knuckle, with non-removable hinge pins. The hinges shall be 5 Knuckle Ball Bearing Hinges by Stanley, or approved equal. Each door shall be fitted with three hinges.

08110.2.7 THRESHOLDS

Shall be extruded aluminum, No. 171A, by Pemko, or approved equal.

08110.2.8 DOOR GASKETING

Shall be vinyl bubble, held in place with aluminum molding around the perimeter of the door.

08110.2.9 DOOR BOTTON PROTECTION

All Doors shall be provided with an aluminum molding with a neoprene gasket, No. 315 AN, by Pemko or approved equal.

08110.3 CONSTRUCTION REQUIREMENTS

08110.3.1 MANUFACTURE AND SHIPPING

All doors and doorframes shall be fabricated in a workmanlike manner. Hardware shall be installed by the door manufacturer. Hardware shall be installed so that the doors operate smoothly and with no binding

Doors shall be checked to assure that no damage has occurred during shipment to the Work site.

08110.3.2 INSTALLATION

08110.3.2.1 DOORS AND FRAMES - All doors and doorframes shall be installed in a workmanlike manner. All doors and frames shall be adjusted so that operation will be smooth, free, easy and with no binding in the hardware between doors and frames. Doors shall be set plumb, square and level at their proper elevation and location. All hardware shall be adjusted to operate smoothly, freely and properly. Door holders shall be installed on the outside of doors such that they will not cross the threshold when the door is opened.

Doors and frames shall be reinforced for hinges, locksets, strikes, flush bolts, etc., as required. Doorknobs are to be 40 inches above the floor to the centerline of the knob.

Wood doors shall be installed in accordance with the National Woodworkers Manufacturing Standards. After fitting at job site, all four edges shall receive two coats of clear compatible lacquer.

08110.3.2.2 STEEL TO ALUMINUM CONTACT - Wherever there is a steel to aluminum contact, the two metals shall be separated by butadyne tape or equal.

08110.3.2.3 GASKETING - Gasketing shall be installed in accordance with the manufacturer's recommendations. Installation of gasketing should be delayed until painting of the door and frame has been completed.

08110.3.2.4 PAINTING - Painting of the doors and frames shall be in accordance with the requirements of Section 09910 of these Specifications. Care shall be taken to assure door hardware is not painted.

08110.4 METHOD OF MEASUREMENT

No separate measurement will be made for doors and frames.

08110.5 BASIS OF PAYMENT

Payment for doors and frames shall be included in the contract unit price for the building on which the doors are installed and accepted.

SPECIAL PROVISION

DOORS, FRAMES, AND HARDWARE	SECTION SP08110

Modify the following section.

08110.2.4.5 KEYING: Locks shall be keyed in conjunction with the existing City of Rock Springs key system. Keying shall be submitted and is subject to Engineer's approval.

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08120.1 DESCRIPTION

This section covers furnishing and installing roof scuttle(s) for entrances into structures as shown on the Drawings an in accordance with the requirements described herein.

08120.1.1 RELATED WORK

Not used.

08120.1.2 SUBMITTALS

The Contractor shall provide complete information, which includes cutaway drawings, parts lists, fabrication details, and manufacturer's installation instructions in accordance with the requirements of Section 01300.

08120.1.2.3 DEFINITIONS

Not used.

08120.2 MATERIALS

08120.2.1 QUALITY CONTROL

This specification is not intended to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance. The Owner reserves the right to reject substitutions if in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

08120.2.2 SCUTTLE

The roof scuttle(s) shall be Type S, as manufactured by The Bilco Company, or approved equal. The scuttle(s) shall be of the size shown on the Drawings.

08120.2.3 COVER AND CURB

Roof scuttle cover and curb shall be fabricated from 11 gauge (minimum) aluminum sheet into a complete assembly with heavy pintle hinges with compression spring operators in telescopic tubes. The cover shall be fitted with a padlock hasp on the outside only and thermoplastic gaskets, which form a tight seal with the top of the curb when closed. The metal curb shall be 12 inches high with a 3 1/2-inch flange. The curb shall be equipped with an integral metal cap flashing of the same gauge and material as the curb, full welded at the corners for weather tightness. The curb and the cover shall be insulated with 1-inch thick rigid fiberboard insulation installed by the manufacturer.

All hardware shall be zinc chromate treated.

08120.3 CONSTRUCTION REQUIREMENTS

The Contractor shall carefully prepare the opening in the structure to provide a neat fit and full clearance with the inside opening space of the scuttle. The scuttle shall then be installed in accordance with the manufacturer’s recommendations and instructions provided on the Drawings. Care shall be taken during installation to ensure that a weather-tight seal will be achieved between the scuttle curb flanges and the structure surface.

08120.4 METHOD OF MEASUREMENT

Separate measurement of the roof scuttle will not be made. Measurement of the scuttle will be included with the building or structure which it serves.

08120.5 BASIS OF PAYMENT

Separate payment for the roof scuttle will not be made.

08122.1 DESCRIPTION

The Contractor shall furnish and install embedded access hatches and associated fittings in designated structures in accordance with the Drawings and these Specifications.

08122.1.1 RELATED WORK

Section 03300 – Concrete Structures and Slabwork

08122.1.2 SUBMITTALS

08122.1.2.1 DESCRIPTIVE LITERATURE - Descriptive literature which identifies the manufacturer, model number, size and materials of fabrication for all equipment and materials furnished under this section shall be provided by the Drawings in accordance with Section 01300 of these Specifications.

08122.1.2.2 CERTIFICATION OF COMPLIANCE - Certification of compliance with the standards and Specifications contained herein shall be obtained from the manufacturer and provided by the Contractor at the time of delivery of these materials to the project site.

08122.1.3 DEFINITIONS

Not used

08122.2 MATERIALS

08122.2.1 QUALITY CONTROL

This specification is not intended to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance. The Owner reserves the right to reject substitutions if in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

08122.2.2 HATCH

The embedded access hatch shall be as manufactured by the Bilco Company, or approved equal. The model number or type shall be shown on the Drawings, but as a minimum shall be equal to a Type K or Type KD, as applicable. Frame shall be ¼" extruded aluminum with built-in neoprene cushion and with strap anchors bolted to exterior. Door leaf shall be ¼" aluminum diamond plate reinforced with aluminum stiffeners as required. Cast steel hinges shall be bolted to underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. Doors shall be built to withstand a live load of 150 pounds per square foot, and equipped with a snap lock and removable handle. Aluminum shall be mill finish, with bituminous coating to be applied to exterior of frame by manufacturer.

08122.2.3 HARDWARE

Hardware shall be zinc plated and chromate sealed. Installation shall be in accordance with manufacturer's instructions. Manufacturer shall guarantee against defects in material or workmanship for a period of five years.

08122.3 CONSTRUCTION REQUIREMENTS

The Contractor shall install all equipment and components under this section in accordance with the manufacturer's installation instructions, the Drawings and these Specifications. Where instructions are unavailable or unnecessary, the Contractor shall at all times use good workmanship practices, applicable building codes, and regulations. The Contractor shall supply and install all miscellaneous fittings required to provide a complete operating system or component, as applicable.

08122.4 METHOD OF MEASUREMENT

08122.4.1 NO MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

08122.4.2 SEPARATE MEASUREMENT

Where items installed under this section are listed separately in the Bid Schedule, the items shall be measured by counting the number of units installed and accepted.

08122.5 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

When a separate bid item is provided in the Bid Schedule, complete compensation for this accepted work shall be included in the contract unit price on the Bid Schedule.

PAY ITEM	UNIT
Embedded Access Hatch (*Type*)	Each

SPECIAL PROVISION

ROLLUP OVERHEAD DOORS — SECTION SP08130

08130.1 DESCRIPTION

Includes furnishing and installing exterior steel commercial duty, rolling service doors and hardware in buildings as shown on the Drawings and specified herein.

08130.1.1 RELATED WORK

Not used.

08130.1.2 SUBMITTALS

08130.1.2.1 DESCRIPTIVE LITERATURE - Descriptive literature which identifies the manufacturer, model number, materials of fabrication, dimensions, description of closure unit, and installation instructions and requirements, shall be provided in accordance with Section 01300.

08130.1.2.2 MANUFACTURER'S INSTRUCTIONS - Manufacturer's instructions for operation and maintenance of the doors and hardware shall be furnished to the Owner prior to the time of final acceptance for payment.

08130.1.2.3 DEFINITIONS

Not used.

08130.2 MATERIALS

08130.2.1 DOOR CURTAINS

Shall consist of interlocking curved or flat slats which are roll-formed from hot-dipped galvanized steel. Slats shall be 20-gauge steel, unless shown otherwise on the Drawings, with a minimum overall depth of 3/4-inches. Lateral movement of slats shall be prevented with end-locks. Each slat void shall be insulated to approximately ½-inch thickness with closed cell foam.

08130.2.2 DOORS

Shall be mounted with a "face-to-wall" installation with a side overlap to the opening of at least 3-inches on each side of the door opening. Bottom edges of doors shall have continuous flexible tubular vinyl weather-stripping installed as a manufacturer's standard.

08130.2.3 FINISH ON THE DOOR CURTAIN AND APPURTENANCES

The finish on the door curtain and appurtenances shall be bright galvanized unless required otherwise on the Drawings in these Specifications. When a paint finish is required, the door curtain shall be phosphate treated for paint adherence.

08130.2.4 GUIDES, WALL ANGLES AND BRACKETS

Shall be fabricated from structural steel angles with a minimum thickness of 3/16-inches to properly retain and support the door.

08130.2.5 BARREL

Shall be fabricated from structural steel pipe with a deflection of not more than 0.03-inches per foot of span. Sealed ball bearings shall be provided at rotating points of the barrel. Springs shall

be oil-tempered, helical-wound, torsion springs, stress relieved after coiling. A galvanized or primer-painted sheet metal hood shall be provided to cover the door when in the open position.

08130.2.6 OPERATION OF THE DOORS

Shall be chain operated as shown on the Drawings and required by these Specifications.

08130.2.7 INTERIOR SLIDE-BOLTS LOCKS

Interior slide-bolts locks suitable for padlocks shall be provided with manual operated doors. Motor operated doors shall be locked by magnetic brake.

08130.3 CONSTRUCTION REQUIREMENTS

Installation of the door shall be made in strict accordance with the door manufacturer's instructions.

08110.4 METHOD OF MEASUREMENT

No separate measurement will be made for overhead doors and their appurtenances which are components of a building indicated as an item in the Bid Schedule.

08110.5 BASIS OF PAYMENT

Payment for overhead doors shall be included in the contract unit price for the building on which the doors are installed and accepted and no separate payment will be provided.

DIVISION 9

FINISHES

SUNRISE
ENGINEERING

09210.1 DESCRIPTION

It shall be the responsibility of the Contractor to coordinate with the Owner and/or the Engineer on the color of paint to be used on the referenced materials.

09210.2 MATERIALS

09210.2.1 CONCRETE AND MASONRY

A. The project building(s) shall be constructed as shown on the plans. Concrete work shall conform to the requirements of Division 3, and shall be Class A concrete. All work shall be neat and workmanlike. The surface of the entire structure, both interior and exterior, shall have any irregularities ground smooth. After being smoothed, the exterior surface of the structure shall be brushed with a mixture of 1/3 water, 1/3 cement, and 1/3 sand. The thickness of the brushed on mixture shall not exceed 1/8 inch.

B. Exposed Concrete or masonry interior walls shall be sealed with a high quality concrete sealer and painted with one coat of white, high gloss enamel paint or other color as may be specified.

C. Unless a different color is specified, the interior floor of the building shall be sealed with a gray industrial cement floor sealer.

09210.2.2 P-TRAPS

Drain piping shall be drain waste and vent (DWV) schedule 40 PVC pipe and fittings sized to fit the floor drain in accordance with the Drawings.

09210.2.3 OTHER SURFACES

A. All plywood and other wood surfaces shall be painted with two coats of wood seal primer and one coat of white, high gloss enamel paint unless other colors are specified.

B. All doors shall be painted with two coats of high gloss epoxy paint.

C. All exposed pipe shall be painted with two coats of high gloss epoxy paint. Where required, the paint shall be color coded to indicate the nature of the material being transported in the pipe.

D. All factory painted items should be approved by the Owner prior to delivery to coordinate color combinations.

09210.3 METHOD OF MEASUREMENT

09210.3.1 This work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

09210.4 BASIS OF PAYMENT

09210.4.1 Complete compensation for the accepted work outlined in this Section shall be included in other bid items.

09910.1 DESCRIPTION

The Contractor shall furnish all labor, materials and equipment necessary to paint all designated components of buildings, piping and equipment in accordance with these Specifications.

09910.1.1 RELATED WORK

Not used.

09910.1.2 SUBMITTALS

09910.1.2.1 DESCRIPTIVE LITERATURE - Descriptive literature identifying manufacturer, type, content, application recommendations, and color samples, shall be provided in accordance with Section 01300 of these Specifications.

09910.1.2.2 DATA FOR PAINT APPROVAL - Complete data on each type and kind of paint and primer shall be submitted to the Engineer for approval. Approval shall be received from the Engineer before the paint is delivered to the jobsite. This procedure must be followed whether or not the paint that the Contractor proposes to use is named in the Specifications. Approval data shall show where and for what uses each paint product is proposed. Information submitted on each proposed type and kind of paint shall include data to show that the paint meets the detailed requirements of these Specifications.

09910.1.2.3 SAMPLES - The Contractor shall prepare and submit sample colors for all items which require color selection by the Engineer. No color selection will be made until all samples of all paints have been submitted. After all samples of all paints have been submitted, the Engineer will prepare a color scheme using the submitted colors. Colors will not necessarily be standard colors with all suppliers. The manufacturer shall mix colors, to secure the desired color when it is not one of his standard colors.

09910.1.2.4 SAND BLAST PANELS - The Contractor, at the beginning of the Project, shall furnish one square foot steel panels sandblasted in accordance with the sandblasting specifications and coated with non-yellowing shellac or clear non-yellowing plastic coating. Panels shall be used as the standards for preparation of steel surfaces for the duration of the project.

09910.1.2.5 PAINT REMNANT - At the end of the project, the Contractor shall turn over to the Engineer a gallon can of each type and color of paint, primer, thinner, or other coating used in the field painting. If the manufacturer packages the material concerned in gallon cans, then it shall be delivered in unopened labeled cans as it comes from the factory. If the manufacturer does not package the material in gallon cans, and in the case of special colors, the materials shall be delivered in new gallon containers, properly closed with typed labels indicating brand, type, color, etc. The manufacturers' literature describing the materials and giving directions for their use shall be furnished in three bound copies. A typewritten inventory list shall be furnished at the time of delivery.

09910.1.3 DEFINITIONS

Submerged Surfaces - In general, items shall be treated as submerged if they are to be at any time under water or are in structures that normally contain water. Unless specified otherwise, anything below the tops of the walls of such structures shall be considered as submerged.

09910.2 MATERIALS

09910.2.1 QUALITY CONTROL

This Specification is not intended to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance. The Owner reserves the right to reject substitutions if in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

09910.2.2 COLOR

The Engineer will make color selection from color samples provided by the Contractor.

09910.2.3 PAINT SELECTION

All paint and coating systems shall include high quality materials, resistant to temperatures up to 130°F, and sunlight exposure. Paints selected shall meet the manufacturer's recommendations and suitability standards for the specific application where it will be used.

09910.2.3.1 MINIMUM REQUIREMENTS - Minimum requirements for paint materials and their application shall be as shown in the tables below:

EXTERIOR PAINT APPLICATION TABLE

Application Substrate	No. of Coats	Paint Materials and Manufacturer*	Coating Thickness (Mils Per Coat)
Wood Siding, Trim, Doors	1	A-100 Exterior Alkyd Wood Primer	2.3
	2	A-100 Exterior Latex Flat House & Trim by Sherwin Williams - OR -	1.3
	1	SUPRIME 8 Exterior	1.3
	2	Pro-Hide Plus Latex Satin House by Pratt & Lambert- OR -	1.3
		System 2H-4 Alkyd by Tnemec	
	1	Tnemec Series 10-99W Undercoater	2.5
	2	2H-Color Hi-Build Tnemec Gloss	2.5
Porous Masonry (Block)		Series 156 Modified Epoxy Sand Texture Finish by Tnemec	
	2	Series 156, 25 BR	4-8
Concrete Walls, Above Grade	1	Loxon Ext. Masonry Acrylic Primer	3.1
	2	A-100 Exterior Latex Satin House & Trim by Sherwin Williams -OR -	1.3
	2	Pro-Hide Plus Latex Satin House by Pratt & Lambert – OR –	1.3
	2	Series 1029 Acrylic Latex Low Sheen by Tnemec	2.5
Metal (Aluminum)	2	A-100 Exterior Latex Satin House & Trim by Sherwin Williams - OR -	1.3
	1	SUPRIME 3 Latex Metal Primer	1.3
Metal (Aluminum) Continued	2	Pro-Hide Plus Latex Satin House by Pratt & Lambert – OR –	1.3
	1	DEFLEX 4020 Primer	3
	1	DEFLEX 4206 S/G Waterborne Acrylic	1.5

Application Substrate	No. of Coats	Paint Materials and Manufacturer*	Coating Thickness (Mils Per Coat)
		Enamel by DeVoe	
Metal, New Steel, (Mild Service)	1 2	Kem Kromik Universal Metal Primer Direct to Metal Enamel by Sherwin Williams - OR -	2.5 3.0
	1 2	SUPRIME 3 Latex Metal Primer Pro-Hide Plus Latex Satin House by Pratt & Lambert – OR –	1.3 1.3
	1 1 2	Devguard 4160 Primer followed by Devguard 4308 Alkyd Enamel or DEFLEX 4218 DTM Enamel by DeVoe	2 2 2
Metal, New Steel, (Severe Service)	1 1	Series 27 WB Typoxy by Tnemec 73-Color Endura-Shield	4 2
Metal, Galvanized Steel, (Mild Service)	1 2	Galvite HS A-100 Exterior Latex Satin House & Trim by Sherwin Williams -OR -	2.0 1.3
	1 2	SUPRIME 2 Latex Metal Primer Pro-Hide Plus Latex Satin House by Pratt & Lambert – OR –	1.3 1.3
	1 2	Devguard 4020 Primer DEFLEX 4206 S/G Waterborne Acrylic Enamel by DeVoe	3 1.5
Metal, Galvanized Steel, (Severe Service)	1 1	Series 27 WB Typoxy by Tnemec Series 10 Primer by Tnemec	4 2
PVC Pipe	 1	System 66-23 Epoxy Polyamide by Tnemec 66-Color Hi-Build Epoxoline	 4

INTERIOR PAINT APPLICATION TABLE

Application Substrate	No. of Coats	Paint Materials and Manufacturer*	Coating Thickness (Mils Per Coat)
Woodwork	1 2	ProMar 200 Alkyd Enamel Undercoater ProMar 200 Int Alkyd Semi-Gloss by Sherwin Williams-OR	1.9 1.7
	1 2	SUPRIME 11 Int Alkyd Wood Primer Pro-Hyde Plus Alkyd Satin by Pratt & Lambert – OR –	1.5 1.5
Woodwork Continued	 1 2	System 2H-4 Alkyd by Tnemec Series 10-99W Tnemec Primers 2H-Color Hi-Build Tnemec Gloss	 2.5 2
Drywall	1 2	ProMar 200 Latex Wall Primer ProMar 200 Int Alkyd Semi-Gloss by Sherwin Williams - OR -	2.5 1.8
	1 2	SUPRIME 1 100% Acrylic MP Primer Pro-Hyde Plus Latex Satin by Pratt & Lambert – OR –	1.1 1.5
		System 6-1 Acrylic Latex Low Sheen	

Application Substrate	No. of Coats	Paint Materials and Manufacturer*	Coating Thickness (Mils Per Coat)
		by Tnemec	
	2	Series 1029 Enduratone	2
Metal (Aluminum)	1	SUPRIME 9 Int/Ext Alkyd Metal Primer	1.1
	2	Pro-Hyde Plus Alkyd Satin by Pratt & Lambert – OR –	1.5
	1	DEFLEX 4020 Primer	3
	1	DEFLEX 4206 Semi-Gloss Waterborne Acrylic Enamel	1.5
Metal, New Steel, (Mild Service)	1	Kem Kromik Universal Metal Primer	2.5
	2	ProMar 200 Int Alkyd Semi-Gloss by Sherwin Williams - OR -	1.7
	1	SUPRIME 9 Int/Ext Alkyd Metal	1.1
	2	Primer Pro-Hyde Plus Alkyd Satin by Pratt & Lambert – OR –	1.5
	1	Devguard 4160 Primer followed by	2
	1	Devguard 4308 Alkyd Enamel or	2.5
	2	DEFLEX 4218 DTM Enamel by DeVoe	2
Metal, New Steel, (Severe Service)		System 66-2 Epoxy Polyamide by Tnemec	
	1	66-1211 Epoxoline Primer	3.5
	1	66-Color Hi-Build Epoxoline	4
Metal, Galvanized Steel, (Mild Service)	1	Galvite Paint	2.0
	2	ProMar 200 Int Alkyd Semi-Gloss by Sherwin Williams - OR -	1.8
	1	SUPRIME 9 Int/Ext Alkyd Metal	1.1
	2	Primer Pro-Hyde Plus Alkyd Satin by Pratt & Lambert – OR –	1.5
	1	Devguard 4020 Primer	3
	2	DEFLEX 4206 S/G Waterborne Acrylic Enamel by DeVoe	1.5
Metal, Galvanized Steel, (Severe Service)		System 66-2 Epoxy Polyamide by Tnemec	
	1	66-1211 Epoxoline Primer	3.5
	1	66-Color Hi-Build Epoxoline	4
Ductile Iron (DI) Pipe and fittings	1	SUPRIME 9 Int/Ext Alkyd Metal	1.1
	2	Primer Pro-Hyde Plus Alkyd Satin by Pratt & Lambert – OR –	1.5
	1	Devguard 4160 Primer followed by	2
	1	Devguard 4308 Alkyd Enamel or	2.5
	2	DEFLEX 4218 DTM Enamel by DeVoe	2
PVC Pipe (Mild Service, Interior Only)		System 6-1 Acrylic Latex Low Sheen by Tnemec	
	2	Series 1029 Enduratone	2
PVC Pipe (Severe Service)		System 66-23 Epoxy Polyamide by	
	1	Tnemec 66-Color Hi-Build Epoxoline	4
Concrete Walls and Ceilings (Mild Service)	1	ProMar 200 Latex Wall Primer	1.1
	2	ProMar 200 Int Alkyd Semi-Gloss by Sherwin Williams - OR -	1.3

Application Substrate	No. of Coats	Paint Materials and Manufacturer*	Coating Thickness (Mils Per Coat)
	1	SUPRIME 4 Latex Wall Primer	1.2
	2	Pro-Hyde Plus Latex Satin by Pratt & Lambert	1.5
Concrete Walls and Ceilings (Severe Service)	2	System 66-4 Epoxy Polyamide by Tnemec Series 27 WB Typoxy by Tnemec	4
Porous Masonry Walls (Mild Service)		Pre-Prime 167 by Devoe	1.5
	1	ProMar 200 Latex Wall Primer	1.1
	2	ProMar 200 Int Alkyd Semi-Gloss by Sherwin Williams - OR -	1.3
	1	SUPRIME 4 Latex Wall Primer	1.2
	2	Pro-Hyde Plus Latex Satin by Pratt & Lambert	1.5
Porous Masonry Walls (Severe Service)		System 66-15 Epoxy Polyamide by Tnemec	
	1	54-660 Masonry Filler	75-100
	2	Series 27 WB Typoxy by Tnemec	4
Concrete Floors (Mild Service)	1	Pre-Prime 167 by Devoe	1.5
	1	Concrete and Terrazzo Sealer (ANCO Cure and Hard by Intermountain Concrete Specialties.	None
	2	Industrial Enamel by Sherwin Williams - OR -	2
	2	With STAND Alkyd Floor Enamel by Pratt & Lambert – OR –	1
	2	Devguard 4328 Alkyd Enamel by DeVoe	2
Concrete Floors (Severe or Mild Service)	2	System 67-1 Epoxy Polyamide Semi-Gloss by Tnemec 67-Color Tneme Tread	2.5

*Brand names of materials have been used to indicate the types and quantities of materials required. Approved equals will be accepted.

09910.2.3.2 PAINT FOR WASTEWATER SYSTEMS - All paint for concrete and metal surfaces in wastewater systems shall be especially adapted for such use.

- Fume Resistance. All paint for final coats shall be fume resistant, compounded with pigments suitable for exposure to sewage gases, especially to hydrogen sulfide and to carbon dioxide. Pigments shall be materials, which do not tend to darken, discolor, or fade due to the action of sewage gases. If a paint manufacturer proposes use of paint which is not designated "fume resistant" in its literature, it shall furnish full information concerning the pigments used in this paint.

- Lead Paint. No lead paints shall be used.

09910.2.3.3 PAINT FOR POTABLE WATER SYSTEMS - All paint systems to be used in potable water service shall meet NSF requirements. See also Subsection 09910.2.3.5 below.

09910.2.3.4 PAINT FOR SUBMERGED SURFACES

- Coal Tar Epoxy. Coal tar epoxy shall meet and conform with Government Specification Mil P-23236 with further qualification that the coal tar epoxy manufacturer and product must be listed on the current U.S. Navy Qualified Products List. Coal tar epoxy shall be subject to the Engineer's approval.

- Alternate Systems. Alternate coating systems for submerged service, such as Epoxy Polyamide Epoxoline by Tnemec, Epoxy Bar Rust 233H, by DeVoe, or equal, may be required for some applications, or may be approved in lieu of coal tar by the Engineer, upon request. Some colors of Epoxy Polyamide Epoxoline, or equal may be acceptable for use in potable water systems, however the manufacturer must be consulted for verification of acceptability prior to use in potable water applications.

09910.2.3.5 HIGH TEMPERATURE SURFACE TO 400°F - Paint for high temperature surfaces shall be DeVoe Hi-Heat Aluminum HT-4, Glidden 592 Metallite Aluminum, or Sherwin-Williams Silver-Brite Heat resisting aluminum paint B59 S1, or approved equal.

09910.2.4 CLEANING MATERIALS

Cleaning materials shall be best quality solvents, chemicals or detergents, which are commercially prepared for preparing painted surfaces and delivered to the site in sealed containers bearing an identifying label and the manufacturer's name.

09910.3 APPLICATION REQUIREMENTS

ALL paint and coating systems shall be applied in strict accordance with the manufacturer's published instructions for use.

09910.3.1 SURFACE PREPARATION

09910.3.1.1 CLEANING - All surfaces to be painted shall be clean and dry except that in some cases the paint manufacturer's directions may require wetting the surface before painting. Grease and oil shall be removed by wiping with mineral spirits or naphtha per Specification SP-1. Rust, scale, welding slag, and spatter shall be removed and the surface prepared by hand tool cleaning, power tool cleaning, or blast cleaning in accordance with the appropriate Specification SP-2 through SP-10.

09910.3.1.2 METAL SURFACES - Except as otherwise provided, all preparation of metal surfaces shall be in accordance with Specifications SP-1 through SP-10 of the Steel Structures Painting Council (SSPC). Sandblasting procedures shall be as follows:

- No surface, which is to be sandblasted, shall be given a coat of primer or paint in the shop or in the field before sandblasting.

- Unless otherwise specified, all iron or steel surfaces which are to be painted as submerged metal shall be dry sandblasted on the site in accordance with Specification SP-10, near white blast cleaning.

- Except as otherwise specified, all metal surfaces, which are to be painted as non-submerged metal, shall be commercial blast cleaned per Specification SP-6. This sandblasting shall be done not more than 12 hours ahead of the painting, subject to humidity and weather conditions between the time of sandblasting and painting operations. If any rusting of sandblasted surfaces occurs before painting, such rusting shall be removed by additional sandblasting.

- Threaded portions of valve and gate stems, machined surfaces intended for sliding contact, surfaces to be assembled against gaskets, surfaces of shafts for sprockets or to fit into bearings, machined surfaces of bronze trim on slide gates, and similar surfaces shall be masked off to protect them from the sandblasting of adjacent surfaces.

- Cadmium-plated or galvanized items shall not be sandblasted except that cadmium plated, zinc-plated, or sheradized fasteners used in assembly of equipment to be sandblasted shall be sandblasted in the same manner as the other metal.

- Surfaces which cannot be sandblasted, or cannot be sandblasted and then painted after the assembly of which they are a part has been completed and placed in final position, shall be sandblasted, or sandblasted and painted, before the items are put into final position. In some cases, while the painting could be done after the items concerned were in place, the limitation on time between sandblasting and painting may make it necessary to paint the surfaces before installation of those items.

- Sand or other media residue from sandblasting operations shall be thoroughly removed, using any method necessary and consistent with the requirements of the painting system, including vacuum cleaners or other means.

09910.3.1.3 GALVANIZED SURFACES - Galvanized surfaces which are to be painted shall first be treated with Koppers No. 40 Metal Conditioner; Amercoat No. 59 as manufactured by Amercoat Corporation, Brea, California; Galvaprep No. 5 as manufactured by Amchem Products, Fremont, California; or approved equal.

09910.3.1.4 CONCRETE SURFACES - Concrete and masonry surfaces shall be free of dust, mortar droppings and spatter, fins, loose concrete particles, form release materials, oil, grease, and other deleterious materials. If required by the coating manufacturer, such surfaces shall be etched as specified below or brush off blast cleaned per Specification SP-7.

Concrete surfaces specified to be acid etched shall be etched with a 15 to 20 percent solution of muriatic or sulfamic acid until the surface has the texture of find sandpaper. The surface shall then be thoroughly scrubbed with clean water, rinsed, and allowed to dry.

09910.3.1.5 WOOD SURFACES - Wood shall be cleaned and dusted immediately prior to painting. Final dusting shall be accomplished using tack cloth. Shelves, drawers, benches, and associated woodwork shall be sanded before painting and lightly sanded between coats. Prior to application of each coat, the surfaces shall be again dusted with tack cloth to remove all dust.

09910.3.1.6 BITUMINOUS PAINTED SURFACES - Surfaces, which are to be painted with other than bituminous paint, and which have a bituminous coating (such as coal tar varnished pipe), shall be sealed with not less than 2 coats of Inertol Tar Stop; Sherwin-Williams Metalatex B42W100; Glidden Insulcap as manufactured by the Glidden Company; or approved equal. This seal coating shall be applied in sufficient quantity to permanently prevent bleeding of the bituminous coating.

09910.3.1.7 HIGH TEMPERATURE SURFACES - In general, high temperature paint shall be applied to exposed (un-insulated) steam line valves and traps, heat exchangers, and miscellaneous metal piping and equipment in piping and mechanical systems exposed to high temperatures. The Contractor shall paint these surfaces with two coats of high temperature paint as specified herein or as otherwise shown or directed. No painting shall be done on surfaces with a temperature in excess of 125 degrees F at the time of application. Immediately before application of the first coat of paint, the surface shall be sandblasted according to SSPC-SP-5 (Blast Cleaning to “white” metal). See also Subsection 09910.3.1.2 above.

09910.3.1.8 THINNING - No thinning of paint other than as directed by the manufacturer's published directions shall be done without the approval of the Engineer. No painting shall be done under conditions, which, in the opinion of the Engineer, will jeopardize the appearance of quality of the painting in any way.

09910.3.1.9 TINTING OF FIRST COAT - When two coats of the same material are specified, the first coat applied shall be tinted with aluminum powder, lampblack, or other suitable pigment to distinguish it from the top coat.

09910.3.1.10 BETWEEN-COATS TREATMENT - All painted surfaces shall be dusted between coats, and high gloss finish shall be lightly sanded and dusted between coats unless otherwise directed by the manufacturer.

09910.3.2 PAINT APPLICATION

09910.3.2.1 PAINTER QUALIFICATIONS - Contractor or subcontractor personnel applying the coating system shall have had past experience in application of the type or types of coatings and under similar conditions that it will be required to meet in this contract. The qualifications of personnel applying the coating system, whether Contractor or subcontractor shall be verified by the Contractor prior to allowing application to proceed. The Contractor shall not subcontract paint application to a subcontractor that is not qualified to apply the coating system.

09910.3.2.2 WEATHER CONDITONS - No painting shall be done under dusty conditions, during or immediately after a rain, during rainy weather, or when the temperature is less than 50°F.

09910.3.2.3 GENERAL REQUIREMENTS FOR APPLICATION OF PAINT – These requirements shall be as follows:

- All work shall be done in a workmanlike manner, leaving the finished surfaces free from drops, ridges, waves, holidays, laps, or brush marks.
- Where possible, prime coats shall be applied by brush and well worked into the surface, unless directed otherwise by the paint manufacturer.
- Other paints may be applied by brush, roller, trowel, or spray, unless manufacturer's recommendations or these Specifications require a particular method of application.
- Primer and intermediate coats of paint shall be un-scarred and completely integral at the time of application of each succeeding coat.
- Each coat shall be subject to the inspection and approval of the Engineer before the next succeeding coat is applied, and defective work of any kind shall be deemed sufficient cause for re-coating the entire surface involved.
- Where spray application is used, each coat of paint shall be applied to a thickness equivalent to a brush coat application at a coverage rate not greater than that specified by the manufacturer for a brush coat application. All spray painting shall be done with airless type spray units.
- The time interval between paint coats shall meet the recommendations of the paint manufacturer, and these Specifications. The Contractor shall not allow excessive time or exposure between coats, where such excessive time or exposure will impair the bond between the coats.

- The number of coats specified in these Specifications is the minimum to be applied. Suction spots between coats shall be touched up, and additional coats shall be provided if required to produce a finished surface with a solid, even color free from defects.

- The total thickness of the coating shall be as specified. Additional coats of paint shall be added if necessary to bring the total thickness up to not less than that specified. For control, the Contractor shall determine the dry film thickness of the coatings on metal surfaces with a correctly calibrated thickness meter. The Contractor also shall check for holidays with a low voltage holiday detector. The Engineer may use the Contractor's meter and detector for additional inspection and checking deemed necessary.

- Particular care shall be used to assure that the specified coverage is secured on the edges and corners of all surfaces. Additional brush coats shall be applied if necessary to ensure coverage of the edges and corners.

- Damaged paint or scratched painted surfaces shall be sanded smooth before repainting. Sanding and repainting shall be done to such a degree and in such a manner that all evidence of the scratches or damages is obscured.

09910.3.2.4 COAL TAR EPOXY – Application of coal tar epoxy shall be as follows:

- Where called for in the Painting Schedule, shown on the Drawings, or required in these Specifications, concrete and some other submerged surfaces shall be coated with not less than two coats of coal tar epoxy.

- Only components from new, previously unopened containers shall be used to mix coal tar epoxy coatings. Coal tar epoxy shall be mixed and applied in accordance with the manufacturer's recommendations. All coating components shall be mixed with power mixers. The time during pouring or stirring will not be allowed as mixing time. The minimum mixing time as recommended by the manufacturer shall be met. Only unit quantities shall be mixed.

- Coal tar epoxy shall be applied to a total dry film thickness of not less than 16 mils.

- Some metal surfaces may require sandblasting prior to application of the coating system. See Subsection 09910.3.1.2 above.

- In some cases it may also be necessary to apply coatings to parts or subassembly surfaces before they are actually installed at their final Project or system location. All support brackets, stem guides, pipe clips, fasteners, etc. that are bolted to concrete shall be painted on all sides.

- Application of coal tar epoxy shall be performed only at the job site unless specific approval is granted for offsite application. Offsite application will not be allowed unless by an applicator with acceptable proven and documented experience in the application of coal tar epoxy systems.

- Each succeeding coat shall be applied over the previous coat as soon as possible in accordance with the manufacturer's instructions, without causing sagging. Succeeding coats shall not be delayed longer than allowed by the manufacturer's instructions. In no case shall the application of subsequent coats be made after the previous coat has set or oxidized. All coats, and the full thickness on all parts, shall be applied before the previous coat has cured. The Contractor shall check the film thickness after application, and before the coating has cured, to ensure that sufficient coating thickness has been applied. If additional coating is

necessary, it shall be applied the same day. Checking and control of thickness at this stage shall be the Contractor's obligation and responsibility and not the Engineer's.

- If the surface coating has been applied for a longer period of time than the limits in the Table below, and if it is found that bituminous paint has not been applied to the specified thickness, the areas that are too thin shall be sandblasted to remove the surface film from the coating. These sandblasted areas shall then be washed and cleaned with the solvent recommended by the manufacturer and shall be re-coated within the time limits specified for coating over fresh bituminous paint. Washing or cleaning the surface of the paint with solvents or other solutions will not be a satisfactory substitute for the specified sandblasting if the painted surface is older than the time limits indicated in the table. This applies even if the paint manufacturer approves the solvent method as adequate for preparing the old surface.

TEMPERATURES AND COATING TIMES

Average Temperature	Maximum Time Between Coats
50 - 60° F	36 hours
60 - 70° F	24 hours
70 - 80° F	12 hours
80 - 120° F	4 hours

Coal tar epoxy shall not be applied when the ambient temperature is less than 50 degrees.

09910.3.2.5 EDGES AND CORNERS - The Contractor is hereby CAUTIONED that the edges and corners of members are difficult places upon which to build the required thickness of paint. The required thickness must be applied to all surfaces, including the corners and edges, by applying as many spray coats as necessary or by additional brush coats on the corners and edges, if necessary, in order to build up the required thickness.

09910.3.3 FINISH SCHEDULE

The Contractor shall finish all work as follows unless indicated otherwise on the Drawings or within these Specifications:

TABLE OF FINISH SCHEDULES

NO FINISH	FACTORY FINISH	SITE FINISH
Stainless Steel Surfaces	Heating Units	Interior Concrete Building Floors and Walls
Polished Aluminum Surfaces	Electric Control Panel Cabinets	Interior Building Walls & Ceiling
Chain Link or Stock Fencing	Cranes & Hoists	All Interior and Exterior Exposed Piping Valves & Pipe Supports
Name Plates	Gauges and Meters	Exposed Electrical Conduit & Junction Boxes
Exterior Concrete	Instruments	Entry Doors and Frames
Exterior Masonry Surfaces	Light Fixtures and Cover Plates	Wood Moldings and Trim
Exposed Plastic Pipe & Fittings	Electrical Wiring & Transformers	Other Exterior Surfaces Indicated on drawings
Warning Labels	Ventilating Fans	
Operating Instructions	Dampers	
Gratings	Air Conditioning Units	
Buried or Encased Pipe	Metal Soffit & Fascia Covering	
	Roofing and Siding	
	Roll-Up Overhead Doors	
	Motors, Pumps, Equipment	

09910.3.4 CLEANUP

Upon completion of painting, the Contractor shall remove all masking and protective covers and properly dispose of all rubbish, debris and unused paint materials. The Contractor shall remove and cleanup all paint overspray, drips, spatters and etc. from any and all surfaces where it does not belong.

09910.4 METHOD OF MEASUREMENT

09910.4.1 NO MEASUREMENT

Separate measurement for Painting will not be made when painting is included as part of an item, building or structure listed in the Bid Schedule.

09910.4.2 SEPARATE MEASUREMENT

Separate measurement for Painting will be made as a Lump Sum when painting is listed as a separate item in the Bid Schedule.

09910.5 BASIS OF PAYMENT

When Painting is included as part of the measurement of another item, structure or building listed in the Bid Schedule, separate payment will not be made.

When Painting is required for a specific item, the accepted quantity will be paid for at the contract unit price for:

PAY ITEM	UNIT
Paint (*Item Description)*	Lump Sum

DIVISION 10

BUILDING SPECIALTIES

SUNRISE
ENGINEERING

10175.1 DESCRIPTION

Includes furnishing and installing gas operated unit space heaters and their controls in designated buildings and equipment enclosures in accordance with the Drawings and these Specifications.

10175.1.1 RELATED WORK

Section 16010 - General Electrical Requirements

10175.1.2 SUBMITTALS

The Contractor shall provide complete information which includes cutaway drawings, parts lists, power requirements, heating capacity and manufacturer's installation instructions in accordance with the requirements of Section 01300.

10175.1.3 DEFINITIONS

Not used.

10175.2 MATERIALS

10175.2.1 FORCED AIR HEATER

Shall be a new unit with an enclosed motor, heat exchanger and fan fabricated from heavy gauge metals which are moisture and corrosion resistant as described on the Drawings. Gas heaters shall be AGA gas certified units and approved by the local gas supplier. Heat exchangers shall have all electric welded construction with 18 gauge (min.) tubes and 16 gauge (min.) header plates of aluminized steel.

All unit heaters shall have adjustable louvers for proper air diffusion and shall be fitted with the following:

- Low voltage combination gas valve containing main and pilot gas cocks,
- Main and pilot gas pressure regulators,
- Redundant solenoid gas valves,
- Pilot solenoid gas valve and 100% safety shut-off, and
- Fan control.

10175.2.2 BURNERS

Shall be made of 18 gauge aluminized steel with type 430 stainless steel ribbon inserts and shall fire directly into the heat exchanger tubes.

10175.2.3 CABINET SIDE PANELS

Shall be of 20 gauge cold rolled steel (minimum) and drain pans of 20 gauge-aluminized steel (minimum).

10175.2.4 MOUNTING BRACKETS

Heaters shall be provided with either wall or ceiling mounting brackets as required.

10175.2.5 FAN MOTORS

Shall be equipped with thermal overheat protection.

10175.2.6 CONTROL OF FORCED AIR HEATERS

Shall be provided thermostatically with the thermostat located on the heater or wall mounted in an efficient location that can be easily operated in the building. Thermostats shall be low voltage, mercury types. All heater units shall be UL listed and shall be manufactured in compliance with NEC and OSHA standards.

10175.3 CONSTRUCTION REQUIREMENTS

Gas heaters shall be furnished and installed in accordance with NEC, OSHA, applicable local requirements and the manufacturer's instructions.

10175.4 METHOD OF MEASUREMENT

10175.4.1 Separate measurement for heaters will not be made when they are furnished and installed as components in a building or enclosure separately identified in the Bid Schedule.

10175.4.2 Separate measurement will be made for heaters furnished and installed only when they are installed as replacement or additional items identified in the Bid Schedule.

10175.5 BASIS OF PAYMENT

10175.5.1 Separate payment for heaters will not be made for heaters furnished and installed as equipment in a building or enclosure identified in the Bid Schedule.

10175.5.2 When furnished and installed separately and shown in the Bid Schedule, the accepted quantity for Gas Space Heaters will be paid for at the contract unit price shown in the Bid Schedule for:

PAY ITEM	UNIT
Install *(Size) (Type)* Space Heater	Each
Replace *(Size) (Type)* Space Heater	Each

10210.1 DESCRIPTION

The Contractor shall furnish and install fans, louvers, dampers, and ventilators in designated buildings and equipment enclosures in accordance with the Drawings and these Specifications.

10210.1.1 RELATED WORK

Section 10125 - Electric Space Heaters
Section 16010 - Electrical System Requirements

10210.1.2 SUBMITTALS

The Contractor shall provide complete information, which includes cutaway drawings, parts lists, and capacity and manufacturer's installation instructions in accordance with the requirements of Section 01300.

10210.1.3 DEFINITIONS

Not used.

10210.2 MATERIALS

10210.2.1 QUALITY CONTROL

This specification is not intended to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance. The Owner reserves the right to reject substitutions if in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

10210.2.2 FANS

10210.2.2.1 WALL FANS - Wall fans shall be new, wall mounted, direct drive fans, mounted in a screened aluminum or steel frame suitable for mounting in an exterior opening. The fan propeller shall be statically and dynamically balanced cast aluminum, rated in accordance with the Air Movement and Control Association (AMCA), Certified Ratings Program, and fitted with ball type bearings. The fan shall have a spun steel venturi/wall base, and a heavy-duty steel power assembly. The fan shall also include an all aluminum motor operated backdraft damper and a ¼ inch by ¼ inch mesh 16 gauge aluminum screen on the inlet, and corrosion resistant fasteners.

The screening shall be removable for maintenance of the motor, and the unit shall be fitted with flanges around the exterior perimeter, which can provide a weather tight fit without additional moldings. The fan motor shall be capable of operating at standard power supply voltages from 110 through 480 volt, single phase or three phase as specified. All wall fans shall be UL listed and shall be manufactured in compliance with NEC and OSHA standards. Noise levels shall not exceed the maximum limits of Section 11010 of these Specifications.

When the Drawings call for wall fans and louvers to be mounted in wall openings, the louvers will typically be installed on the wall exterior to protect the fan. Both the louvers and the fan units should be removable or coordinated for convenient maintenance. Power actuated louvers shall be connected such that they open automatically when the fan is energized.

10210.2.2.2 TUBE FANS - Tube fans shall be new, direct drive, tube type fan units capable of being mounted directly in a circular pipe duct. The fan motor and housing shall be fabricated from corrosion

resistant steel, aluminum, or plastic and shall be capable of operating in both a vertical or horizontal orientation. The fan propeller shall be rated in accordance with the AMCA Certified Ratings Program. The fan shall have straightening vanes, which are heliarc welded at the discharge side of the unit to eliminate turbulence. The fan shall have a pre-wired twist lock disconnect, and the motor shall be out of the air-stream. The fan wheel shall incorporate true airfoil blades, which are heliarc welded to the hub with non-overloading characteristics. The fan support bracket shall include an extruded rubber isolator. The fan motor shall use ball bearings and shall be capable of operating on a 110 through 480 volt, single phase or three phase standard power supply, as specified. All tube fans shall be UL listed and shall be manufactured in compliance with NEC and OSHA standards. Noise levels shall not exceed the maximum limits of Section 11010 of these Specifications.

10210.2.3 LOUVERS AND DAMPERS

10210.2.3.1 MECHANICALLY OPERATED LOUVERS - Mechanically operated louvers shall be the type and size shown on the Drawings, and shall be as manufactured by the Airolite Company, Penn Ventilator Company, Vent Products Company, Inc., or approved equal. The frame and blades shall be 0.080 6063T5 extruded aluminum, with a standard mill finish, and the frames shall be formed to fit the openings. Blades shall be accurately fitted and firmly secured to the frames. The edges of all louver blades shall be folded or beaded for rigidity. The louvers shall include blade edge seals, and a flange mounting system, unless otherwise shown on the Drawings. Axles shall be ½-inch minimum diameter x 2-inch long plated steel rods. Bearings shall be ½-inch minimum diameter nylon. All louvers and dampers shall be furnished with ¼-inch by ¼-inch mesh 16-gauge aluminum bird screens in a standard folded frame, installed on the inside face of fixed louvers, on outside face for adjustable or automatic louvers, unless shown otherwise on the Drawings. Unless specified otherwise, mechanically operated louvers shall close automatically when the fan is not operating. Louvers shall receive a Class I anodized coating.

10210.2.3.2 POWERED LOUVERS - Where powered operators are required, the louvers shall be fully equipped and set up with the powered operators installed. Powered operators shall be sized as shown on the drawings and shall be as manufactured by Barber Coleman, or approved equal.

10210.2.3.3 FIXED LOUVERS - Galvanized steel fixed louvers shall be a complete factory assembled unit with stationary blades welded securely to the frame and of the size and configuration shown on the Drawings. Louvers shall be fabricated from 10 gauge galvanized steel sheet and fit with a #10 copper alloy insect screen soldered to the inside surface of the louvered opening. Unless shown otherwise in the CONTRACT DOCUMENTS, painting of galvanized louvers will not be required.

10210.2.3.4 DOOR LOUVERS - Door louvers shall be complete factory assembled, adjustable steel (19 gauge min.) door louvers with manually operated shutters, which can be closed tight. The louvers shall be fit with mounting brackets, which form a tight fit around the opening in the door. The louver shall incorporate a factory installed coating system. The color shall be as selected and approved by the OWNER. The louver shall be the model, size and configuration shown on the Drawings. When no size is shown on the Drawings, door louvers shall be 12 inches by 24 inches.

10210.2.4 ROOF VENTILATORS

10210.2.4.1 POWERED ROOF VENTILATORS - Powered roof ventilators for attic ventilation shall operate automatically on a thermostat that can be adjusted between 60°F and 120°F. The ventilators shall be sized as shown on the Drawings. The units shall include built-in safety firestats in the thermostat housings that will automatically shut off power to the units if the temperature reaches or exceeds 170°F, to prevent the vent from drawing in more air in the event of a fire. The units shall be of all metal construction of either galvanized steel, aluminum, or both. No plastic domes or flashing plates shall be used. The units shall incorporate an integral screen of 1/8-inch mesh

maximum, to keep out birds and large insects. Appropriate flashing and lap cement shall be installed to ensure that the vents are fully weatherproof.

10210.2.4.2 WIND DRIVEN TURBINES - Wind driven turbine roof ventilators installed to remove hot attic air and to prevent condensation under winter conditions, shall be 12-inch internally braced turbine ventilators, as shown on the Drawings. Ventilators shall be constructed of 24-gauge galvanized steel with an aluminum painted finish, and shall have ribbed blades for added strength. Turbine ventilators shall use hard chrome plated DuPont Delrin bearing systems, or approved equal. The ventilator shall be supplied with an integral automatic damper, designed to fit inside the 12-inch turbine base and turbine with base units. The damper shall be fully open at 90°F and shall be fully closed at 50°F. When installed on pitched roofs the ventilator shall employ an angle adjustable base, which will allow the ventilator to be installed with the axis of ventilator rotation plumb. Appropriate flashing and lap cement shall be installed to ensure that the vents are fully weatherproof.

10210.2.5 TURBINE VENTILATORS FOR ROOM VENTILATION

Wind driven turbine roof ventilators installed to circulate and vent warm air out of building spaces shall be 12-inch internally braced turbine ventilators, as shown on the Drawings. Ventilators shall be constructed of 24-gauge galvanized steel with an aluminum painted finish, and shall have ribbed blades for added strength. Turbine ventilators shall use hard chrome plated DuPont Delrin bearing systems, or approved equal. The ventilator shall be supplied with an integral thermally actuated automatic damper, designed to fit inside the 12-inch turbine base and turbine with base units. The damper shall be fully open at 90°F and shall be fully closed at 50°F. When installed on pitched roofs the ventilator shall employ an angle adjustable base, which will allow the ventilator to be installed with the axis of ventilator rotation plumb. Turbine roof ventilators used for room ventilation shall incorporate ductwork through the roof, attic spaces and ceiling. A factory painted aluminum or vinyl louvered grille shall be fastened to the ceiling to cover the duct opening in the ceiling. The louver shall closely match the interior ceiling colors. The ductwork shall be 24 gauge galvanized steel, minimum. Appropriate flashing and lap cement shall be installed to ensure that the vents are fully weatherproof.

10210.3 CONSTRUCTION REQUIREMENTS

Fans, louvers, dampers and ventilators shall be installed at the locations shown on the Drawings. Installations shall be in strict accordance with the manufacturer's installation instructions, NEC, OSHA, applicable local codes and requirements, the Drawings, and these Specifications. Wall openings shall be as shown on the Drawings.

Equipment installed in a concrete or masonry opening shall be mounted with expansion anchors through the frame or flange, or as otherwise detailed on the Drawings. Equipment installed in a wood framed opening shall be installed using lag screws or bolts, or as otherwise detailed on the Drawings. Where a caulked seal is required, ventilation equipment shall be provided with caulking stops. After installation, all joints between the equipment and the opening shall be caulked.

10210.4 METHOD OF MEASUREMENT

10210.4.1 NO MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

10210.4.2 SEPARATE MEASUREMENT

Where items installed under this section are listed separately in the Bid Schedule, the items shall be measured by counting the completed and accepted units.

10210.5 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

When a separate bid item is provided in the Bid Schedule, complete compensation for this accepted work shall be included in the contract unit price on the Bid Schedule.

PAY ITEM	UNIT
Install (*Size*) (*Type*) Louvers	Each
Replace (*Size*) (*Type*) Louvers	Each
Install (*Size*) (*Type*) Fan	Each
Replace (*Size*) (*Type*) Fan	Each
Install (*Size*) (*Type*) Damper	Each
Replace (*Size*) (*Type*) Damper	Each
Install (*Size*) (*Type*) Roof Ventilator	Each
Replace (*Size*) (*Type*) Roof Ventilator	Each
Install (*Size*) (*Type*) Room Ventilator	Each
Replace (*Size*) (*Type*) Room Ventilator	Each

10220.1 DESCRIPTION

Includes furnishing and installing evaporative air coolers and associated controls in designated buildings and equipment enclosures in accordance with the Drawings and these Specifications.

10220.1.1 RELATED WORK

Section 16010 - General Electrical Requirements

10220.1.3 SUBMITTALS

The Contractor shall provide shop drawings, parts lists, and manufacturer's operations and maintenance manuals in accordance with the requirements of Section 01300.

10220.1.3 DEFINITIONS

Not used.

10220.2 MATERIALS

10220.2.1 EVAPORATIVE AIR COOLERS

Each evaporative air cooler shall have an industry standard rating which meets or exceeds the rating indicated in the Contract Documents. Coolers shall be as manufactured, or with the same or better quality, as provided by ARVIN, ESSICK. The type, size and capacity of the cooler unit/s shall be as shown on the Drawings or described in the Special Provisions.

Evaporative air coolers shall be new units with heavy duty construction; be provided with CELdek$_{TM}$ (or approved equal) evaporative media for evaporation; PVC or ABS plastic water distribution trays; and each shall be provided with UV-stabilized PVC water louvers.

The minimum motor horsepower shall be 3/4 HP operating at 115 or 230 volts, single-phase AC supply.

10220.3 CONSTRUCTION REQUIREMENTS

Evaporative air coolers shall be furnished and installed in accordance with the project Drawings, these Specifications, and the manufacturer's instructions. Evaporative air coolers shall be rigidly mounted to the building with mechanical fasteners as shown on the Drawings and as approved by the Engineer. Mounting brackets shall be square and plumb, and the unit and all associated brackets shall be factory finished for protection against corrosion. Unless otherwise shown on the Drawings or instructed by the Engineer, a single square duct will route cool air into the building. A square register shall be provided to diffuse air into the building at the discharge of the duct.

10220.4 METHOD OF MEASUREMENT

10220.4.1 NO MEASUREMENT

Separate measurement for Evaporative Air Coolers will not be made when they are furnished and installed as electrical work for a building or enclosure separately measured and identified in the Bid Schedule.

10220.4.2 SEPARATE MEASUREMENT

Separate measurement will be made for each Evaporative Air Cooler furnished and installed when installed as replacement or additional items identified in the Bid Schedule.

10220.5 BASIS OF PAYMENT

Separate payment will not be made for Evaporative Air Coolers furnished and installed as equipment in a building or enclosure identified in the Bid Schedule.

The accepted quantity of evaporative air coolers will be paid for at the contract unit price shown in the Bid Schedule for:

PAY ITEM	UNIT
Install Evaporative Air Cooler	Each
Replace Evaporative Air Cooler	Each

10400.1 DESCRIPTION

This section covers furnishing and installing safety and hand railings and their supporting fixtures, frames, and/or hardware in buildings or on other structures. Materials and locations of installation are to be as shown on the Drawings or required in these Specifications.

10400.1.1 RELATED WORK

Not used.

10400.1.2 SUBMITTALS

10400.1.2.1 DESCRIPTIVE INFORMATION - The Contractor shall provide descriptive information which shows detailed dimensions of rails and posts, material composition, details of fittings or anchors required for fastening, finishing, manufacturer's name, loading bearing capacity and manufacturer's installation instructions in accordance with the requirements of Section 01300.

10400.1.2.2 COMPLIANCE WITH STANDARDS - Evidence of these materials complying with applicable industrial safety standards shall be provided. In cases where a potential exists for the railing to serve public access, compliance with the Uniform Federal Accessibility Standards shall be required.

10400.1.3 DEFINITIONS

Not used.

10400.2 MATERIALS

10400.2.1 ALUMINUM RAILING

Shall be extruded aluminum pipe with posts and fittings specifically manufactured for installation as handrails. Aluminum pipe materials shall have a minimum outside diameter of 2.0-inches. Spans between posts or mounting brackets shall not exceed 6-feet. Mounting screws and fasteners shall be stainless steel. Aluminum components of the railings shall be anodized and the railing shall be given a Class I architectural finish.

10400.2.2 FIBERGLASS RAILING

Shall be composite fiberglass with continuous glass fibers along the axial span and may be round or square tubing manufactured specifically for handrails. The resin used for the composition shall be fire retardant polyester. The color of the railings shall be yellow unless indicated otherwise by the Engineer. Railing installed where exposure to sunlight is possible, shall be provided with an ultraviolet (UV) light protection coating. Maintenance and repair instructions shall be provided to the Engineer with the submittal information indicated above. Metal hardware and materials furnished for mounting fiberglass handrails shall be stainless steel.

10400.2.3 STEEL PIPE RAILING

Shall be welded carbon steel pipe with posts and support fittings specifically manufactured for installation as handrails. Railing materials shall have a minimum outside diameter of 1.90-inches and a minimum wall thickness of 0.145-inches. Spans between posts or mounting brackets shall not exceed 6-feet. Mounting screws and fasteners shall be stainless steel. Following installation, all railings, posts and fittings shall be given two coats of gloss enamel epoxy paint of the color and as approved by the Engineer.

10400.2.4 TOP RAILINGS

Shall be continuous in sections up to 12-feet in length. When joints in the railings become necessary, they will be assembled tight and free from any sharp edges or burrs or nicks. All posts shall be single unspliced pipe lengths. Welds shall be ground smooth and finished to provide an uninterrupted surface.

10400.3 CONSTRUCTION REQUIREMENTS

Railing components shall be furnished from the same manufacturer and shall be installed in careful accordance with the manufacturer's instructions. All screwed or bolted fasteners shall be drawn up tight so that the completed railing is rigid and free of movements at joints and attachments.

10400.4 METHOD OF MEASUREMENT

10400.4.1 NO MEASUREMENT

No separate measurement shall be made for furnishing and installing railings when they are components of a structure or building shown on the Bid Schedule.

10400.4.2 SEPARATE MEASUREMENT

When shown as an item on the Bid Schedule, measurement shall be made for each linear foot of each type and configuration of railing furnished and installed. Such measurement shall include the posts and the supporting frame when normally furnished as a unit.

10400.5 BASIS OF PAYMENT

Separate payment for railings will not be made when they are furnished and installed as components in a building or enclosure identified in the Bid Schedule.

The accepted quantity of railings measured separately will be paid for at the contract unit price shown in the Bid Schedule for:

PAY ITEM	UNIT
(*Name*) Railings (*Size*) (*Type*)	Lineal Foot

ALUMINUM HANDRAIL (NON-WELDED PIPE) SECTION 10410

10410.1 DESCRIPTION

The Contractor shall furnish and install aluminum handrails as shown on the Drawings and required by these Specifications. One manufacturer shall supply all aluminum railings used on the project.

10410.1.1 RELATED WORK

Not used.

10410.1.2 SUBMITTALS

10410.1.2.1 DESCRIPTIVE LITERATURE - Descriptive literature which identifies the manufacturer, load capacity, and materials of fabrication for all items furnished under this section shall be provided by the Contractor in accordance with Section 01300 of these Specifications.

10410.1.2.2 CERTIFICATION OF COMPLIANCE - Certification of compliance to the standards and Specifications contained herein shall be obtained from the manufacturer and provided by the Contractor at the time of delivery of these materials to the project site.

10410.1.3 DEFINITIONS

Not used.

10410.2 MATERIALS

10410.2.1 QUALITY CONTROL

This specification is not intended to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance. The Owner reserves the right to reject substitutions if in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

10410.2.2 FEDERAL SAFETY STANDARDS

The handrail system shall comply with minimum Federal safety standards

10410.2.3 HANDRAIL SYSTEMS

10401.2.3.1 MANUFACTURE - Handrail systems shall be the ReynoRail Aluminum Railing System, Connectorail Aluminum Railing system, or approved equal. All fastenings and fasteners shall be as recommended or furnished by the manufacturer.

10410.2.3.2 COMPOSITION - All rails, posts, and fitting-assembly spacers shall be formed from 6063-T5 or T6 extruded aluminum pipe of 1.9-inch OD and 0.145-inch wall thickness. Kick plates shall be fabricated of aluminum alloy 6061-T6. All other aluminum parts shall be 6063 extruded aluminum or F514.0 aluminum castings. Unexposed parts shall be Type 300 series stainless steel. All components shall be completely fabricated and assembled without welding. Plug screws or blind rivets shall be Type 305 stainless steel.

10410.2.3.3 FINISH - Aluminum railing components shall be given a Class I architectural anodized finish on all exposed surfaces after cutting, 4 mils on castings, and 0.7 mils on pipe. Aluminum shall be pretreated before anodizing for cleaning and removing all markings. Anodizing finish shall be clear.

10410.2.3.4 TOE BOARDS - The handrail system shall include toe boards where indicated on the Drawings and on all open sides of walkways or platforms where a person can pass beneath the walkway or platform, where there is moving machinery or where there is equipment with which falling material could create a hazard.

Toe boards shall be 4-inches nominal in vertical height from top edge to level of the floor or walkway. They shall be securely fastened in place with not more than 1/4-inch clearance above floor level.

10410.2.4 GATE MATERIALS

Aluminum gate materials, quality, design and workmanship shall be similar to the aluminum railing, and shall be designed as part of the railing system. Hinges shall be installed so that each gate can swing 180 degrees from the closed position to the fully open position. Gates shall swing to the walkway side of the handrail only. Gate stops shall be installed on the stationary railing posts to prohibit gates from swinging the wrong direction. Latch assemblies shall be of a durable self-locking type. Construction and installation of each gate frame, hinges, gate stops and latch shall conform to OSHA minimum strength requirements. Gate closing springs shall be stainless steel.

10410.3 CONSTRUCTION REQUIREMENTS

The Contractor install handrails where shown on the Drawings in accordance with the manufacturer's recommendations.

10410.3.1 WORKMANSHIP AND PROTECTION OF FINISH

The Contractor shall be responsible for the workmanship, rigidity, and protection of the system finish. He shall use all precautions necessary to protect the finish from scratches, nicks, gouges, dents, etc. during assembly and installation.

10410.3.2 ASSEMBLY AND INSTALLATION

10410.3.2.1 HANDRAIL SYSTEMS – Procedure shall be as follows:

- All pipe cuts shall be square and accurate for minimum joint-gap. Cuts shall be clean and straight, free of burrs and nicks. All holes shall be drilled and countersunk the proper size, as required for a tight, flush fit of assembly screws and all other component parts.

- All fastenings and fasteners shall be as recommended or furnished by the manufacturer, except that pipe rails shall be fastened to fittings with series 300 stainless steel pop rivets or flush set screws.

- Rail shall be erected straight, level, plumb, and true to the positions as indicated on the Drawings. Any deviation from the true line or grade, which is visible to the eye, shall be corrected.

- Posts shall be installed as single un-spliced pipe lengths. Post spacing shall not exceed 6 feet on center. All other attachment brackets shall be spaced as specified on the manufacturer's installation Drawings.
- Top rails shall be continuous whenever possible. Single, un-spliced lengths shall be attached to a minimum of 3 posts in all cases. Lower rails shall be single, un-spliced lengths between posts.

- Where protection is applied for prevention of dissimilar materials electrolysis, care shall be taken that none of the protective material is visible when assembly is completed.

- Fasteners shall be appropriately installed and drawn up tight with a hand wrench or screw driver so that completed railing is rigid and completely free of play at all joints and attachments. All hook bolts shall be tightened to torque recommended by the manufacturer.

10410.3.2.2 ALUMINUM GATES - Aluminum gates shall be installed at openings in the handrails where shown on the Drawings. Each gate shall consist of a gate frame, hinges, gate stops, and a latch. Each gate, in the closed position, shall be in a vertical plane with the handrail.

10410.4 METHOD OF MEASUREMENT

10410.4.1 NO MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

10410.4.2 SEPARATE MEASUREMENT

Where items to be furnished and installed under this section are listed separately in the Bid Schedule, quantities shall be established by using a tape measure or other accurate measuring device to determine the total number of lineal feet of handrail system installed and accepted. This measurement shall include all gates, components, and fittings.

10410.5 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

When a separate bid item is provided in the Bid Schedule, complete compensation for this accepted work shall be included in the contract unit price on the Bid Schedule.

PAY ITEM	UNIT
Aluminum Handrail System	Lineal Foot

10420.1 DESCRIPTION

The Contractor shall furnish and install steel safety and hand railings and their supporting frames and/or hardware in buildings or other structures at locations shown on the Drawings and as required by these Specifications.

10420.1.1 RELATED WORK

Not used.

10420.1.2 SUBMITTALS

10420.1.2.1 DESCRIPTIVE INFORMATION - The Contractor shall provide descriptive information which shows detailed dimensions of rails and posts, material composition, details of fittings or anchors required for fastening, finishing, manufacturer's name, loading bearing capacity and manufacturer's installation instructions in accordance with the requirements of Section 01300.

10420.1.2.2 CERTIFICATION OF COMPLIANCE - Certification of compliance to the standards and Specifications contained herein shall be obtained from the manufacturer and provided by the Contractor at the time of delivery of these materials to the project site.

10420.1.2.3 EVIDENCE OF STANDARDS - Evidence of these materials complying with applicable industrial safety standards shall be provided. In cases where a potential exists for the railing to serve public access, compliance with the Uniform Federal Accessibility Standards shall be required.

110420.1.3 DEFINITIONS

Not used.

10420.2 MATERIALS

10420.2.1 QUALITY CONTROL

This specification is not intended to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance. The Owner reserves the right to reject substitutions if in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

10420.2.2 FEDERAL SAFETY STANDARDS

The railings system shall comply with minimum Federal safety standards.

10420.2.3 HANDRAIL SYSTEMS

10420.2.3.1 MANUFACTURE - Steel pipe handrail systems shall be by R. B. Wagner, Inc., or approved equal. One manufacturer shall supply all railings of each specific type used on the project.

10420.2.3.2 COMPOSITION - The steel tubing handrail system shall be carbon steel, galvanized steel, or stainless steel, as required on the Drawings, and shall be round or square configuration as shown. Handrail components, including tubing, posts and support fittings, shall be specifically manufactured for handrail installation. Round tubing shall have a minimum outside diameter of 1.90-inches and the minimum wall thickness of handrail material shall be 0.145-inches. All posts shall be single unspliced lengths.

10420.2.3.3 TOE BOARDS - The handrail system shall include toe boards on all open sides of walkways or platforms where a person can pass beneath the walkway or platform, where there is moving machinery or where there is equipment with which falling material could create a hazard.

Toe boards shall be 4-inches nominal in vertical height from top edge to level of the floor or walkway. They shall be securely fastened in place with not more than 1/4-inch clearance above floor level.

10420.2.3.4 FINISH - Stainless steel and hot dipped galvanized handrail systems shall have no factory-applied coatings, and stainless steel railings shall have a satin finish.

10420.2.3.5 HARDWARE - Mounting anchors and all fasteners shall be stainless steel, unless otherwise approved by the Engineer.

10420.2.4 GATE MATERIALS

Handrail system gate materials, quality, design and workmanship shall be similar to the railing, and shall be designed as part of the railing system. Hinges shall be installed so that each gate can swing 180 degrees from the closed position to the fully open position. Gates shall swing to the walkway side of the handrail only. Gate stops shall be installed on the stationary railing posts to prohibit gates from swinging the wrong direction. Latch assemblies shall be of a durable self-locking type. Construction and installation of each gate frame, hinges, gate stops and latch shall conform to OSHA minimum strength requirements. Gate closing springs shall be stainless steel.

10420.3 CONSTRUCTION REQUIREMENTS

The Contractor shall install handrails, as shown on the Drawings, in strict accordance with the manufacturer's installation instructions.

10420.3.1 WORKMANSHIP AND PROTECTION OF SYSTEM

The Contractor shall use all precautions necessary to protect the handrail system from damage until final acceptance.

10420.3.2 ASSEMBLY AND INSTALLATION

10420.3.2.1 HANDRAIL SYSTEMS – Procedure shall be as follows:

- All pipe cuts shall be square, clean, straight, and accurate. Welds shall be ground smooth and finished to provide an uninterrupted surface without burrs or nicks.
- Spans between posts and/or mounting brackets shall not exceed 6-feet. Joints shall be made through the use of standard flush weld techniques with uniform locking weld connectors.
- All screwed or bolted fasteners shall be drawn up tight so that the completed railing is rigid and free of movement at all attachments.

10420.3.2.2 GATES - Handrail gates shall be installed at handrail openings where shown on the Drawings. Each gate shall consist of a gate frame, hinges, gate stops, and a latch. Each gate in the closed position shall be in a vertical plane with the handrail.

10420.3.2.3 FINISH - Following installation, all carbon steel railings, posts and fittings shall be given two coats of gloss enamel epoxy paint, in accordance with Section 09910 of these Specifications. The color shall be selected and approved- by the Engineer.

10420.4 METHOD OF MEASUREMENT

10420.4.1 NO MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

10420.4.2 SEPARATE MEASUREMENT

Where items to be furnished and installed under this section are listed separately in the Bid Schedule, quantities shall be established by using a tape measure or other accurate measuring device to determine the total number of lineal feet of handrail system installed and accepted. This measurement shall include all gates, components, and fittings.

10420.5 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

When a separate bid item is provided in the Bid Schedule, complete compensation for this accepted work shall be included in the contract unit price on the Bid Schedule.

PAY ITEM	UNIT
Steel Handrail System	Lineal Foot

DIVISION 11

PROCESS AND MECHANICAL EQUIPMENT

SUNRISE
ENGINEERING

11010.1 DESCRIPTION

This section is included for guidance in the selection and installation of mechanical equipment. The requirements contained herein apply to all items of mechanical equipment the same as if these provisions were contained in the individual part of the Specifications for the equipment.

11010.1.1 RELATED WORK

Not used.

11010.1.2 SUBMITTALS

11010.1.2.1 SHOP DRAWINGS – Shop drawings shall be submitted as follows:

- The Contractor shall submit Shop Drawings to the Engineer for approval on all mechanical equipment to be furnished under this Contract in accordance with Section 01300. The number of copies submitted shall be four, PLUS the number of copies the Contractor wishes to have returned.

- Prior to submitting the drawings, the Contractor shall review the information for completeness. Only complete information will be reviewed by the Engineer, and only after the Contractor has signified his approval of the information. Shop drawings will not be approved until cut-away or assembly drawings, with part and material specification lists, have been submitted.

- Shop drawings shall consist of a cover sheet which indicates intended use and data summary, outline drawings, cut-away drawings, parts lists, material specification lists, and all information required to substantiate that the proposed equipment meets the Specifications. In some special cases reproducible transparencies of Shop Drawings shall be furnished to the Engineer in addition to the above mentioned number of copies.

- Shop drawings for motors shall include published dimension sheets and shall include a motor data sheet which shows all the motor characteristics, i.e., horsepower, voltage, code letter, design letter, service factor, enclosure, insulation, etc. All characteristics of the motor shall be shown on the data sheet, which shall be approved by the Engineer prior to delivery of the motor.

- Shop drawings for pumps shall include make, style, speed, size, type, head-capacity, efficiency, materials used, design features, weights, etc. All characteristics of the pump shall be shown on the data sheet, which shall be approved by the Engineer prior to delivery.

- The Contractor shall assume the responsibility to ensure that approved guards for all drive units, pulleys, or rotating shafting are detailed on Shop Drawings and submitted with them to the Engineer for approval.

11010.1.2.2 PARTS CALCULATIONS AND DETAILS - The Contractor shall provide calculations and details on all parts individually and collectively to show that the equipment offered satisfies the performance, strength, vibration, and other requirements of these Specifications.

11010.1.2.3 GEAR REDUCTION UNITS - The Contractor shall submit complete engineering information, catalog data, design features, load capacities, and mechanical efficiency ratings for each gear reduction unit incorporated in the work. This information shall also be included in the equipment Operation and Maintenance Manuals, as described herein.

11010.1.2.4 OPERATION AND MAINTENANCE MANUALS - The Contractor shall furnish to the Owner four (4) copies of Operation and Maintenance (O & M) Manuals for each system or item in accordance with Section 01300 of these Specifications and as follows:

- O & M manuals shall be broken down into sections. The sections shall include Mechanical Equipment, Automatic and Special Valves, Control Systems, Electrical, and other additional sections as necessary. All sections shall be labeled and each item shall be sub-labeled. Each section shall include a description of the operation and maintenance of each item or component included in that section.
- There shall be included in the front of each manual an index laminated with plastic on both sides for protection against rough use.
- Each manual shall be bound in hard cover
- The manuals shall be delivered to the Owner prior to installation of any operating equipment.
- No acceptance of any equipment will be made until the complete manuals have been submitted, evaluated and approved.
- One copy of the complete manual shall be at the jobsite available for use by the Contractor's field personnel, the Owner, and the Engineer during installation, start-up and testing of the equipment.

11010.1.3 DEFINITIONS

Not used.

11010.2 EQUIPMENT

11010.2.1 QUALITY CONTROL

All equipment shall be the product of a manufacturer experienced in the design, construction, and operation of equipment for the purpose required. The manufacturer shall have furnished such equipment long enough to be able to show a record of successful operation for a period of not less than two years. When two or more units of equipment for the same purpose are required, they shall be products of the same manufacturer.

11010.2.2 MANUFACTURER'S GUARANTEE

Manufacturers or suppliers of all equipment furnished under this contract shall guarantee said equipment for a period of 1 full year from the date of Substantial Completion or Final Acceptance of the work in accordance with Section 00700.29 of these Specifications. Equipment shall be made up of parts which are designed to act as a unit; and the manufacturer shall guarantee that when the component parts are assembled into the final unit, these parts will fit and operate satisfactorily.

11010.2.3 ACCOMMODATION TO SEA LEVEL

The elevation of this project above sea level is shown on Drawings. Design and performance of all mechanical equipment shall conform thereto.

11010.2.4 GENERAL REQUIREMENTS

11010.2.4.1 HEAVY DUTY RATING - The manufacturer shall rate all mechanical items heavy duty. All parts of equipment shall be amply proportioned for all stresses, which may occur during operation and for any additional stresses, which may occur during fabrication and erection. Unless specified otherwise, all bearings shall be sized as a minimum for 100,000-hour service at maximum loading under AFMBA B-10 conditions.

11010.2.4.2 STEEL AND IRON - Structural steel shall conform to ASTM A 36. Iron castings shall be tough close-grained gray iron castings in accordance with ASTM A 48.

11010.2.4.3 FASTENERS - All fasteners for aluminum shall be stainless steel. All steel other than stainless steel shall be isolated from aluminum with stainless steel, neoprene, or other approved material.

11010.2.4.4 MODIFICATIONS TO PRODUCTION LINE EQUIPMENT - Modifications shall be made in manufacturer's equipment to make it conform to the specific requirements of the Drawings and Specifications, if the standard product does not fulfill all requirements.

11010.2.4.5 PRODUCTION LINE IMPROVEMENTS - All equipment shall include all production line improvements made prior to the contract or delivery date.

11010.2.5 MOTORS

11010.2.5.1 GENERAL - The purpose of this subsection is to identify and define premium quality electric motors having high electrical and mechanical integrity and energy efficient operation under adverse operating conditions to give maximum life and minimum life cycle costs.

11010.2.5.2 COMPLIANCE – Standards for motors are as follows:

- Motors shall be totally enclosed, either fan-cooled or non-ventilated, squirrel-cage induction motors, NEMA frame size 182T through 449T, as indicated on the Drawings or prescribed in the Special Provisions. Motors shall be Reliance XE or approved equal.
- All motors covered by this specification shall conform to the latest applicable requirements of NEMA, IEEE, ANSI, and NEC standards, including IEEE Std. 841.
- Motors shall be designed for continuous duty for 3-phase, 60 HZ, 200, 230, 230/460 or 575 volt operation, NEMA design B.
- Ratings shall be based on a 40°C ambient temperature and on operation at the given project altitude. Ratings shall provide for a maximum resistance temperature rise of 80°C at a service factor of 1.0, and a 90°C rise at a service factor of 1.15, through 150HP.
- Motors shall be furnished with Class F insulation, 1.15 service factor but shall be selected for operation within their full load rating without applying the service factor.
- Motors shall be of a premium efficient design and shall be different from the manufacturer's standard efficient product.
- Motors shall be evaluated on conformance to this specification and total costs including initial cost and operating life-cycle cost. Life-cycle cost to be based on motor efficiency evaluation at a stated dollar penalty per kilowatt of motor losses based on specific operating conditions.

11010.2.5.3 CONSTRUCTION - Motor rotor construction shall be die cast aluminum or fabricated copper or their respective alloys. Rotors on frames 213T and above shall be keyed to shaft and rotating assembly dynamically balanced to and .0005 inches peak to peak 182T-326T frames, and .00075 inches peak to peak 364T-449T frames. Balance weights, if required, shall be secured to the rotor resistance ring or fan blades by rivets. Machine screws and nuts are prohibited. The entire rotating assembly between bearing inner caps shall be coated with a corrosion-resistant epoxy.

11010.2.5.4 MECHANICAL – Mechanical requirements shall be as follows:

- Bearings shall be ball, open, single row deep groove, Conrad type, and shall have a Class 3 internal fit conforming to AFBMA Std. 20. For belted duty applications, drive end bearing may be cylindrical roller type.

- Bearings shall be selected to provide L10 rating life of 17,500 hours minimum for belted applications, 100,000 hours minimum for flexible direct coupled applications. Calculations shall be based on external loads using NEMA belted applications limits per MG1-14.07 and typical sheave weights and internal loads defined by the manufacturer including magnetic pull and rotating assembly weight.

- Bearing temperature rise at rated load shall not exceed 60°C 3600 RPM or 50°C 1800 RPM and slower. Temperature rise is to be measured by RTD or thermocouple at bearing outer race.

- Bearing AFBMA identification number shall be stamped on motor nameplate.

- Motor lubrication system shall consist of a grease inlet on motor bracket with capped grease fitting on inlet, grease relief plug 180 degree from inlet, grease reservoir in bracket and grease reservoir in cast inner cap.

- Motor to be greased by manufacturer with a premium moisture resistant polyurea thickened grease containing rust inhibitors and suitable for operation over temperature from -25°C to 120°C.

- Bearings shall be protected by INPRO/SEAL bearing isolators on both ends of the motor unless otherwise approved by the Engineer.

11010.2.5.5 ENCLOSURE – Motor enclosure including frame with integrally cast feet, end brackets, locking bearing inner caps, fan guards, and conduit box and cover shall be cast iron, ASTM Type A-48, Class 25 or better.

11010.2.5.6 CONDUIT BOX - Motor conduit box shall be cast iron construction; rotatable in 90-degree increments, diagonally split with tapped NPT threaded conduit entrance hole. Neoprene conduit box cover gasket and neoprene lead seal gasket between box and motor frame shall be furnished. The conduit box shall incorporate a mounted, clamp-type ground lug.

11010.2.5.7 COOLING FAN – The external cooling fan shall be corrosion-resistant, non-sparking, bi-directional, keyed, clamped and shouldered on the motor shaft.

11010.2.5.8 BREATHER DRAINS - Stainless steel automatic breather drains shall be provided in the lowest part of both front and back end brackets to allow drainage of condensation.

11010.2.5.9 MOUNTING HARDWARE - All mounting hardware shall be hex head, high strength, SAE Grade 5, plated for corrosion protection. Screwdriver slot fasteners are prohibited. A forged, steel, shouldered eyebolt shall be provided on all frames. Eyebolt receptacle shall be threaded and designed to prevent moisture or foreign material from entering motor when eyebolt is removed.

11010.2.5.10 NAMEPLATE - Corrosion resistant stainless steel nameplate shall be affixed to motor frame with stainless steel or brass drive pins. Nameplate(s) shall include all required NEMA data and AFBMA bearing numbers, and connection diagram for dual voltage motors.

11010.2.5.11 SHAFT SLINGER - An external V-ring shaft slinger shall be provided on both shaft extensions 254T and larger and on the drive end shaft only 182T-215T to minimize entrance of moisture or foreign material into bearing cavity.

11010.2.5.12 CORROSION PROTECTION - Frame to end bracket assembly of machined parts shall be protected and sealed by application of thick corrosion-resistant material to the machine surfaces prior to assembly.

11010.2.5.13 ELECTRICAL – Electrical requirements shall be as follows:

- All motors shall successfully operate under power supply variations per NEMA MG1-14.30.
- All motors shall be NEMA Design B with torque and starting currents in accordance with NEMA MG1-12.35 and 12.38 except in special applications requiring higher starting torques where NEMA Design C is permitted.
- Motors shall have copper windings.
- Motor insulation system shall be Class F minimum, utilizing materials and insulation systems evaluated in accordance with IEEE 117 classification tests.
- Motor leads shall be nonwicking type, Class F temperature rating or better and permanently numbered for identification.
- The entire wound and insulated stator shall receive an additional coating of epoxy paint on all air gap surfaces, to protect against moisture and corrosion.

11010.2.5.14 FACTORY TESTING - Each completed and assembled motor shall receive a routine factory test per NEMA standards.

11010.2.5.15 NOISE - The no-load sound pressure level, based on the A-weighted scale at 3 feet when measured in accordance with IEEE Std. 85 should not exceed 85 DBA.

11010.2.5.16 EFFICIENCY - All motors shall be of an energy-efficient design, different from manufacturer's standard product through the use of premium materials, design and improved manufacturing process, that reduces motor losses approximately 40% from standard efficient designs, and whose minimum efficiencies exceed NEMA Table MG1-12.6C. Motor efficiency shall be determined in accordance with NEMA Standard MG1-12.54 and full load efficiency labeled on motor nameplate in accordance with NEMA Standard MG1-12.55.

11010.2.5.17 FINISH - All motor parts including frame, brackets, fan cover, and terminal box shall receive a minimum of two coats of high grade USDA accepted epoxy paint. Motor assembly must satisfactorily withstand salt spray tests for corrosion per ASTM B-117 for 96 hours.

11010.2.6 PUMPS

11010.2.6.1 GENERAL - The Contractor shall furnish, install, and test all pumps. Pumps shall be of heavy-duty construction for heavy-duty continuous service or for intermittent service, whichever imposes the most severe service on the pump. Pumps of inferior design or make will not be accepted.

11010.2.6.2 MECHANICAL DEFECTS - Mechanical defects shall include excessive vibration, improper balancing of any rotating parts, improper tolerances, binding, excessive motor heating, defective materials, improper fitting of parts, and any other defect which will in time damage the pump or pumps or unreasonably impair the efficiency of the pumps.

11010.2.6.3 CAUSE FOR REJECTION – Rejection of pumps for cause will be as follows:

- Pumps that have mechanical defects or do not meet the range of head-capacity characteristics, efficiency, and vibration requirements will be rejected and shall be replaced at the Contractor's full expense for furnishing, installing, removal, and replacement.

- If it is found upon delivery that the pump materials do not agree with the requirements of the Specifications as to size, type, quality, or metallurgy, they will be rejected as unfit for use on this project. Bronze or brass parts of any pump in contact with the pumped liquid shall contain no aluminum nor greater than six percent zinc.

11010.2.6.4 FRICTION LOSSES - Pump friction losses, including entrance, column, shaft, and discharge losses shall be added to the total dynamic heads that are specified under each pump in order to get the head that the impeller must pump against. Pump head-capacity curves shall indicate that these losses have been included.

11010.2.6.5 PRESSURE GAUGES - Pumps shall be tapped at the suction and discharge for pressure gauges. In general, all pumps that can be tested by pressure gauges shall be provided with suitable taps on both suction and discharge. Taps may be in pumps or in adjacent pipes within three inches of the pump flange.

11010.2.6.6 TESTING - Each and every pump, with its motor, drive, gearing, etc., shall be checked run, and tested at the place of manufacture. In addition, all pumps shall be volumetrically tested as to head-capacity requirements and for the purpose of cross checking the calibration of meters as required by the Engineer, after installation. Four certified laboratory performance curves for each pump shall be submitted to the Engineer for approval before shipment of the pump.

11010.2.7 MECHANICAL POWER TRANSMISSION EQUIPMENT

All mechanical power transmission equipment including V-belts, sheaves, chains, sprockets, mechanical variable speed drives, gear reducers, open and enclosed gearing, clutches, brakes shall be rated for 24-hour a day service and sized with a minimum service factor of 1.5. The 1.5 service factor shall be related to the nameplated HP and torque of the prime source of power and not the equipment actual loading. Should the manufacturer recommend a service factor larger than 50%, the manufacturer's recommendation shall take precedence.

11010.2.8 GEAR REDUCTION UNITS

11010.2.8.1 CONSTRUCTION - Unless otherwise specified, all gear reduction units shall be helical or herringbone type. No planetary gear units shall be used for any purpose, and worm gear type units may be used only where specified. Gears of gear reduction units shall be made of highest quality alloys treated for hardness and severe service. The complete reduction unit shall be fully enclosed

in a heavy cast iron housing with gears running in oil. All bearings shall be of the anti-friction type.

11010.2.8.2 CLASS OF SERVICE - Gear reduction units shall be selected for the class of service specified. The class of service must be determined by the manufacturer of the gear reduction units after being informed by the Contractor as to what equipment the units are to be used for and to what type of duty the equipment will be subjected. Where no class of service is specified, gear reduction unit class of service shall be Class II or heavier, as required, as classified by the American Gear Manufacturers Association.

11010.2.8.3 CAPACITY AND PERFORMANCE - The actual and rated horsepower capacity, torque, overhung capacity, and bearing capacity of each reduction unit shall be not less than the horsepower rating of the drive motor nor less than that which will be encountered under full load and under the most severe operating conditions which the equipment will be called upon to operate. The Engineer may reject any gear reduction unit that does not meet the above requirements. Only gear reduction units of long established manufacture and reputation may be used.

11010.2.9 SPECIAL TOOLS

All special tools that are required to assemble, disassemble, repair, and maintain any item of mechanical equipment shall be furnished with the equipment. Special tools shall include any type of tool that has been specifically made for use on an item of equipment for assembly, disassembly, repair, and maintenance. When special tools are provided, they shall be marked or tagged, and a list of such tools shall be included with the maintenance and operation instructions describing the use of each marked tool.

11010.2.10 LUBRICATION FITTINGS

All lubrication fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housing, or guards. Fittings shall be accessible from safe, permanent walk or walk areas without ladders, scaffolds, etc. Fittings shall be Lincoln "Bullneck" Hydraulic Surface Check Fittings (Lincoln Engineering Co., St. Louis, Missouri), or approved equivalent. Lubrication fittings shall be mounted together wherever possible. They shall not be individual fittings field mounted together, but use shall be made of factory-mounted multiple fitting assemblies located in convenient area. Connection from multiple fitting assemblies to point of use shall be minimum 3/16" stainless steel tubing, securely mounted parallel with equipment lines and protected where exposed to damage.

11010.2.11 MACHINERY AND EQUIPMENT GUARDS

11010.2.11.1 CONSTRUCTION AND INSTALLATION - All machinery drive units, pulleys, or rotating shafting shall be furnished with approved guards, shields, or barriers. Such guards, shields, or barriers shall be neatly and substantially constructed, adequately supported from adjacent framing,. Guards shall be constructed of 6061-T6 aluminum unless otherwise indicated. The frame shall be covered with expanded aluminum for heat dissipation. All guards shall be isolated so no dissimilar metals come into contact.

All guards shall be sized to allow installation of pulleys up to and including 15 percent over size. The width of the guard shall be such as to allow one additional belt to be added in the future.

11010.2.11.2 COMPLIANCE - Guards shall be provided in all cases where required by state or OSHA or local codes. While all such guards may not be shown in detail on the Drawings, the Contractor is

expected to be familiar with the requirements of local, state, and federal regulations regarding machinery guards and safety devices.

11010.2.12 PAINTING

All equipment furnished for the project shall be painted in accordance with the requirements of Division 9 of these Specifications.

11010.3 EQUIPMENT CONSTRUCTION, INSTALLATION, AND TESTING

11010.3.1 GENERAL

The furnishing and installation of equipment shall include testing, painting, checking levels and alignment, furnishing and placing of lubricants of whatever type, and furnishing of factory-trained service mechanics or engineers where called for. All equipment when finally installed shall be complete and ready for operation without binding or overloading of critical components or motors. The Contractor shall furnish at no extra cost to the Owner all appurtenances, piping, valves, fittings, wiring, supports, hangers, etc., as are required to place the equipment in first-class operating condition and in a near and workmanlike manner.

11010.3.2 INSTALLATION

11010.3.2.1 GENERAL - Equipment shall be installed complete and ready to operate by skilled craftsmen. Each craftsman employed to install a specific type of equipment shall be thoroughly trained in the particular trade required to install that equipment.

All moving parts of equipment and machinery shall be carefully installed, tested for operation, and adjusted so that all parts move freely and function to secure satisfactory operation.

11010.3.2.2 WELDING - Qualified welders in accordance with applicable welding codes and procedures shall perform all welding. Welding shall be by electric arc, unless otherwise shown on the Drawings or required by these Specifications.

11010.3.2.3 ANCHOR BOLTS - Anchor bolts for heavy equipment shall be encased in metal tubing having an inside diameter not less than two times that of the bolt, unless otherwise detailed on the Drawings. Foundations for pumps, motors and other equipment shall be left one inch below the grade of machine base unless otherwise required on the Drawings. After the proper setting of machine for alignment and grade, the recess below the equipment base, together with recess between the anchor bolt and the metal tube, shall be grouted and carefully finished with non shrink grout.

11010.3.2.4 PIPING - All piping required for proper operation of equipment shall be installed. Piping layouts may require modification from that shown on the Drawings depending on equipment furnished. All costs for piping or piping modifications required to suit the particular equipment furnished shall be borne by the Contractor.

11010.3.2.5 ELECTRICAL - Unless otherwise specified herein all electrical work, materials and equipment shall conform to the provisions of Division 16, Electrical of these Specifications. It shall be the responsibility of the Contractor to provide complete electrical systems sized to suit the equipment furnished and installed.

11010.3.2.6 ALIGNMENT OF MOTORS AND EQUIPMENT – Alignment of motors and equipment shall be as follows:

- In general, checking and correcting the alignment shall follow the procedures established in Section B (1X) of the Standards of the Hydraulic Institute, Instructions for Installation, Operation, and Maintenance of Centrifugal Pumps, as applicable.

- In all cases, the equipment shall be properly leveled and brought into angular and parallel alignment.

- Equipment bases shall not be grouted nor foundation bolts finally tightened until all piping connections are complete and in satisfactory alignment, such that no strain is transmitted to the equipment.

- In every case where a drive unit is connected to a driven piece of equipment by a flexible coupling, the coupling halves shall be disconnected and the alignment between the motor and the equipment checked and corrected after the complete unit has been leveled on its foundation. The alignment shall then be checked and corrected again after the grout has cured and the foundation bolts have been tightened.

11010.3.2.7 GROUTING – Grouting shall be performed as follows:

- Machinery shall first be perfectly aligned and leveled by means of steel wedges and shims near the anchor bolts. Anchor bolts shall be tightened against the shims on wedges before placing grout.

- Before grout placement, equipment foundations shall be prepared by chipping, hammering or sand blasting the entire concrete surface which will be grouted to remove any dirt or grease and to expose the concrete aggregate, unless approved otherwise by the Engineer.

- The equipment shall again be checked for level and alignment.

- The roughened foundation shall then be thoroughly cleaned, and the grout shall be thoroughly packed into place, filling all voids under the base of equipment.

- Special non-shrink grout shall be used in the placement of all heavy equipment and equipment bases. Non-shrink grout shall be as specified in Division 3 of these Specifications.

- Grout around all machinery bases shall be neatly pointed. All sandblast residue, grease, and debris shall be removed before any grout placement is started.

11010.3.3 TESTING

11010.3.3.1 GENERAL - Before testing, all equipment and mechanisms shall be filled by the Contractor with the proper amounts and types of oil and grease as recommended by the equipment manufacturer. The Contractor shall furnish all personnel, chemicals, and other necessary items as are required for the initial testing of equipment.

11010.3.3.2 DURATION OF TEST - Generally each piece of equipment, which in its normal use will operate for prolonged periods, shall be operated by the Contractor for at least 24 hours after installation, unless the Engineer is satisfied that a shorter test period is adequate. Satisfactory completion of this test does not relieve the Contractor of his responsibility in the event of binding, overloading, over-heating, or other equipment failure or malfunction after initial testing is performed.

11010.3.3.3 VIBRATION - The prime supplier shall make field tests for acceptable vibration in the on all pumps or other equipment with rotating shafts and/or a drive unit. Units shall be field tested for vibration after installation using the following process:

- All vibration testing shall be performed in the presence of and be witnessed by the Engineer. Testing shall be as required by the Engineer at various speeds between maximum and minimum. The Engineer shall be furnished a complete copy of vibration test data for each test performed.
- Each unit shall be tested separately with no other unit running.
- Drive systems, complete with motors, in place at the jobsite shall not vibrate more than 0.012 amplitude inch. Amplitude as used in this Section shall mean total peak-to-peak displacement, and it shall be measured by an IRD Vibration Meter, Model 306, or approved equal.
- All field tests shall be running tests with the drive unit driving the equipment.
- The equipment shall be free of static unbalance; shall be free of dynamic unbalance up to the maximum speed of the drive system; shall have the torsional critical speed 20 percent above the maximum speed of the pump and drive system.
- Vibration that occurs at the rotational critical speed shall not be greater than 0.012 amplitude inch; and shall be free of apparent unbalance caused by defective bearings, by close-fitting parts which may rub on the rotating parts intermittently, by loose discs or rotor parts, unbalanced loads, or by oil whip.
- Unless directed otherwise by the Engineer, vibration shall be measured at the top of the motor.

11010.3.3.4 NOISE LEVELS – Noise levels for the equipment and motors shall be measured in the field in accordance with AGMA 295.03. The combination equipment and motor, shall be designed to emit not more than 85 dBA when the measurements of the "C" network of the sound level meter are converted to "A" network readings or read directly on "A" network, unless otherwise specified. The manufacturer shall guarantee the sound levels specified. Enclosures built over the units are not acceptable as a means to meet specified sound levels. Each piece of equipment and its driver shall be tested through the range of possible operating speeds.

11010.4 METHOD OF MEASUREMENT

Not used.

11010.5 BASIS OF PAYMENT

Not used.

DIVISION 14

SPECIAL MECHANICAL SYSTEMS

SUNRISE
ENGINEERING

SPECIAL PROVISION

VERTICAL TURBINE BOOSTER PUMPS CROSSROADS PUMP STATION	SECTION SP 14581

14581.1 DESCRIPTION

A. The contractor shall provide all equipment labor and materials to furnish and install the 480 Volt, 3 Phase, 60 Hz vertical turbine canned pumps and motors.

B. Submittals. Shop drawing submittals and additional submittals. The Contractor shall be required to submit a complete shop drawing submittal. Five copies, plus the number of copies the Contractor wishes returned, shall be submitted to the Engineer for approval.

1. Pump supplier will provide a letter from the pump manufacturer stating the following requirement has been met:
    a. All parts will be supplied and assembled by the pump manufacturer at the pump manufacturer's facility.

2. Name of nearest location of permanent parts supply from which parts maybe obtained in sufficient quantity on a 24-hour basis.

3. Performance data curves (adjusted for operating speed) showing head, capacity, horsepower demand, and pump efficiency over the entireoperating range of the pump, from shutoff to maximum capacity. The equipment manufactured shall indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the specified design point.

4. Equipment manufactured shall provide complete and detailed information regarding the installation of the pumps. Any installation requirements or operating conditions which the supplier or manufacturer feels to be critical to the safe and reliable operation of the pumps should be identified and described in detail.

5. 4 copies of Operating and Maintenance manuals and Maintenance Summary Sheets for the equipment specified herein shall be furnished.

6. Manufacturer's warranty.

14581.2 PUMPS

A. General:

Pump Name (Quantity) Crossroads Booster Pump (4)

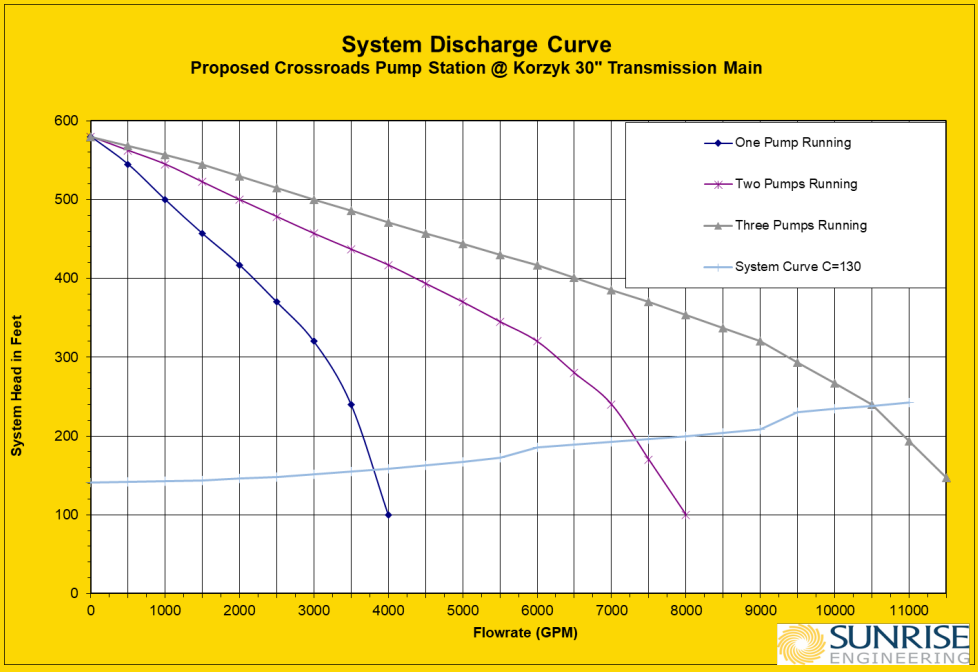
B. Operating Conditions: The work of this section shall be suitable for long term operation and all pumps and motors shall be capable of operating within specified parameters and without permanent damage, under the following conditions:

Duty Drive	Continuous Variable Speed
Ambient Environment	Indoors
Ambient Temperature, (degrees F) Ambient	40 to 100
Relative Humidity (percent)	35 to 95
Fluid Service	Potable Water
Fluid Temperature, (degrees F) Fluid	40 to 70
pH Range	6 to 8
Project Site Elevation (ft, m.s.l.)	6,236

C. Performance Requirements:

Maximum Shutoff Head (ft)	550+/- ft
Normal Operating Head Range	156 ft (one pump – net lift head) 239 ft (three pumps – net lift head)
Design Flow Capacity (gpm/pump) (pump testing shall be at design flow and head)	3,700 (one pump) 3,500 (three pumps)
Suction Pressure (ft)	70ft
Design flow minimum bowl efficiency (percent)	82.0
Maximum pump speed (rpm)	1,800
Maximum motor speed (rpm)	1,800
Estimated Motor Size (hp)	325 (Verify with MFG)

System Curve



14581.3 MANUFACTURER

A. The specifications and project drawings depict National Pump Company H14MC (5 Stage) and controls. The contractor shall prepare his bid based on the specified equipment for purposes of determining low bid. Award of a contract shall constitute an obligation to furnish the specified equipment and materials, except as allowed below:

Flowserve Pump Company VPC Pumps
Xylem Goulds VIC Vertical Industrial Can Type Model 16DHLO

shall be considered an equal and approved for base bid equipment.

B. After execution of the contract, the contractor may offer substitutions to the specified equipment for consideration.

C. In event the contractor obtains Engineer's approval for equipment substitution, the contractor shall, at his own expense, make all resulting changes to the enclosures, buildings, piping or electrical systems as required to accommodate the proposed equipment. Revised detail drawings illustrating the substituted equipment shall be submitted to the engineer prior to acceptance.

D. It will be assumed that if the cost to the contractor is less for the proposed substitution, then the contract price shall be reduced by an amount equal to 50% of the savings.

14581.4 PUMP CONSTRUCTION

A. Pump. The pump system shall consist of Four (4) National Pump Company model H14MC five stage pumps or equal as defined in 14581.3. Each Pump shall be capable of continuous operation singly or in combination of two or three pumps running.

These pumps will be sequenced to provide flows between to between 2,000 gpm (one pump - VFD @ 60%) and 10,500 gpm (3 pumps) while boosting between 156 and 239 feet of TDH while operating within the safe operating parameters as provided by the manufacturer through the use of a VFD. The sequence of operation will alternate among the four pumps to balance run time.

The pumps shall be of the line-shaft vertical turbine multi-stage can pump design.

The suction/discharge base shall have ANSI Class 150# connections design as indicated in the drawings or pump schedule.

B. Bowl Assembly. The pump bowls shall be flanged type constructed of close grained cast iron conform to ASTM A48, class 30. They shall be free from sand holes, blowholes, or other faults and must be accurately machined and fitted to close tolerances. They shall be capable of withstanding a hydrostatic pressure equal to twice the pressure at rated flow or 1.5 times shut-off head, whichever is greater. The intermediate bowls shall have epoxy lined

waterways for maximum efficiency and wear protection. All intermediate bowls shall be of identical design for interchangeability. All the bowls shall be fitted with C-844 bronze bearings. All wetted parts shall be coated fusion bonded epoxy coating with Scotchkote 134 minimum thickness of 12 mills or approve equal.

C. Impellers. The impellers shall be constructed from ASTM B584 Silicon Bronze and shall be the enclosed (or semi-open) type. They shall be free from defects and must be accurately cast, machined and filed for optimum performance and minimum vibration. Impellers shall be balanced to grade G6.3 of ISO 1940 as minimum. They shall be securely fastened to the bowl shaft with taper locks of 416 stainless steel.

D. Suction. The suction bowl or suction bell shall be provided with a non-soluble grease packed bronze bearing. A bronze sand collar shall be provided to protect this bearing from abrasives in the pumping fluids. The bearing housing shall have sufficient opening at the bottom for easy removal of the bearing. The basket strainer shall be 316 stainless steel. The maximum opening shall not be more than 75% of the maximum opening of the water passage through the bowl or impeller.

E. Shaft. The bowl shaft shall be constructed from ASTM 582 type 416 stainless steel. It shall be precision ground and polished with surface finish better than 40 RMS. Shaft shall be sized for a critical speed of at least 20% above maximum operating speed.

F. Pump shall be equipped with a ¼" stainless steel flush line from the mechanical seals back into the sump.

14581.5 COLUMN ASSEMBLY – OPEN LINESHAFT

A. Column Pipe. The column pipe shall be furnished in single sections and shall be connected by threaded-sleeve couplings (or flanges). The pipes shall be of ASTM A53 grade B steel pipe and the weight shall be not less than schedule 30. The end of the pipe shall be threaded with 8 threads per inch with 3/16" taper per foot thread and faced parallel to butt against the centering spiders of ASTM B584 Silicon Bronze to form accurate alignment. (All column flange faces shall be parallel and machined for rabbet fit to permit accurate alignment.) The inside diameter of the pipe shall be such that the head losses shall not be more than 5 feet per 100 feet of pipe. Column pipe shall be coated fusion bonded epoxy coating with Scotchkote 134 minimum thickness of 12 mills.

B. Lineshaft. The lineshaft shall be of ASTM A582 type 416 stainless steel ground and polished with surface finish not to exceed 40 RMS. They shall be furnished in interchangeable sections not over ten feet in length, and shall be coupled with threaded stainless steel couplings (up to 2-15/16" diameter) machined from solid steel bar. It shall have left-hand thread to tighten during pump operation. The diameter of the shaft and coupling shall be designed in according with AWWA E101 Standard.

C. Bearing. Bearing shall be fluted rubber retained in the centering spider by a shoulder on each end of the bearing.

14581.6 DISCHARGE HEAD ASSEMBLY

A. Discharge Head. It shall be of the high-profile type to allow shaft coupled above stuffing box and provided for mounting the driver and support column and bowl assemblies. It shall be fabricated steel. The above ground outlet shall be flanged to match 10-inch ANSI class 300 (for steel). It shall have a 1/2" NPT connection for a pressure gauge. Cast Iron Discharge Heads will not be acceptable. Discharge head shall be coated fusion bonded epoxy coating with Scotchkote 134 minimum thickness of 12 mills.

B. Stuffing Box. The stuffing box shall be cast iron and shall contain a cartridge design mechanical seal. Flow Serve ISC or equivalent.

C. An adjustable shaft coupling shall be provided at the discharge head for setting the impeller to bowl running clearance.

14581.7 SHAFT SEAL

A. General. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard.

14581.8 MOTOR

A. General. The motor shall be a heavy-duty squirrel cage induction type, NEMA Class B or Class F insulation with WP-1 enclosure, Premium Efficient, Inverter Duty, 1800 RPM solid shaft motor, with a non-reverse ratchet (or self-release coupling) to prevent reverse rotation of the rotating elements. A thrust bearing of ample capacity to carry the weight of all rotating parts plus the maximum hydraulic thrust load under all conditions of operation calculated L10 life shall be no less than 8800 hours. Provision shall be made for momentary up thrust equal to 30% of the rated down thrust. The motor shall be standard (or premium) efficiency, 1.15 service factor, and suitable for use on 480 volts, three phase, 60 Hz electric service.

14581.9 VARIABLE FREQUENCY DRIVES

A. General. Refer to Section 26 29 23 of the specifications.

14581.10 WARRANTY

A. General. The minimum warranty period shall be a non-prorated period of 12 months from date of substantial completion.

14581.11 REED FREQUENCY ANALYSIS

General. An analysis of the discharge head, motor support, thrust stand components, along with the pump driver (electric motor, right angle gear, etc.) to determine if the combined natural frequency of these components matches the pump operating speed. The Reed critical frequency shall avoid +/- 10% of the operating speed for pumps on VFD's.

All tests must be submitted to the ENGINEER prior to shipment of the pumps for approval.

14581.12 SPARE PARTS

General. Contractor shall provide the following spare parts:

a. One mechanical seal

14581.13 INSTALLATION

The Contractor shall provide all labor, equipment, and materials required to furnish and install the fully functional Feed Pump System as shown on the Drawings and as required by these Specifications. The Contractor shallcomplete all work and install all equipment and components at the locations required in accordance with the equipment manufacturer's recommendations and the requirements of these specifications. The pump system supplier shall provide up to 8 hours of onsite training on his equipment at no additional cost to the Owner.

14581.14 FIELD TESTING

Pumps shall be flow tested after installation. Flow and head shall match the approved pump curves. Amperage shall also be measured and shall be within the manufacturer's allowable limits.

Field Vibration tests for acceptable vibration will be made at no additional cost to the Owner in the field on each pump. All field tests will be running tests with the pump pumping water and each pump system will be tested separately with no other pumps running. All tests will be done in the presence of the design engineer. Amplitude as used in this specification will mean peak to peak displacement, the requirement for testing for acceptable vibration will be the measurement of this peak to peak displacement at 5 separate points on the motor and five separate points on the discharge head. The vibration tests will be performed by using a Vibxpert manufactured by Pruftechnik or equal.

14581.15 SUPPLIER

The supplier of the pump, motor and appurtenances shall have been in business for not less than 10 years. The primary function of the supplier shall be water pumps and motors. This supplier shall have sole responsibility for all materials contained within this specification section.

14581.16 METHOD MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in the Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

Where items under this section are listed separately in the Bid Schedule, the items shall be measured as a lump sum for all materials, labor, and equipment necessary to install one

automatically controlled triplex pumping unit as shown on the DRAWINGS and as specified herein.

14581.17 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

When a separate bid item is provided in the Bid Schedule, complete compensation for this accepted work shall be included in the contract unit price on the Bid Schedule.

PAY ITEM	UNIT
Pumping Unit Control Panel	Lump Sum
Pump Column, Motor, Pump Can	Each

DIVISION 15

MECHANICAL

SUNRISE
ENGINEERING

SPECIAL PROVISION

Steel Cylinder Water Pipe — **SECTION SP 15110**

15110.1 DESCRIPTION

The Contractor shall furnish, test, install, and place into satisfactory operation the mortar lined and polyurethane coated steel cylinder pipe, and appurtenances as herein specified and as shown on the Drawings.

15110.1.2 SUBMITTALS

A. Pipe Layout Drawings. Pipe (30-inches and larger) shall be fabricated to adhere to the contract construction drawings. The Contractor shall submit pipe layout drawings for approval by the Engineer and highlight any variation from the alignment or grade shown on the contract drawings. These drawings shall be the same scale as the contract drawings. The Owner will allow the manufacturer to utilize a set of reproducible contract drawings to reflect the proposed deviations from the planned grades. Departures from line and grade within the following parameters will be permitted in the manufacture of the pipe to allow the use of joint pulls to effect changes of alignment:

1. Horizontal alignment shall be within 4-inches of the alignment shown on the contract drawings.

2. In vertical alignment, depth may be reduced 1 inch or increased 4- inches if the following minimum vertical clearances between outside diameters of other facilities are maintained and no additional high points are created:

   a) 1 foot vertical clearance between sewer and water pipelines.

   b) 2 foot vertical clearance between oil and gas pipelines.

   c) 0.5 foot vertical clearance between all dry facilities except when specifically shown otherwise on the contract drawings.

3. Horizontal location of the vertical P.1. may deviate by 2.0 feet. (Pipe smaller than 36 inch may be straight run pipe with horizontal and vertical bends fabricated to conform to construction drawings and welded to straight run pipe with butt straps. or other approved full welded joint connections.)

4. Proposed departures in excess of these limits must be approved by the Engineer prior to initiation of layout drawings.

Computer printouts will be accepted in lieu of layout drawings except for such proposed departures.

B. Fabricated Steel Plate Specials. Fabricated steel plate specials submittals shall be approved prior to fabrication. The dimensions shall conform to AWWA C-208 except as modified herein or as otherwise shown on the plans.

1. Pipe Outlets. The measurement from the outside of pipe to the face of flange shall be 12" unless otherwise shown. Outlets shall be designed per AWWA Manual M-11 , and design of stiffener plates shall follow the nomograph method.

   Pipe outlets shall also be provided for chlorination corp stops, air valve assemblies, services, and other appurtenances required by the contract drawings. Brass plugs shall be provided for installation upon later removal of the chlorination corp stops.

2. Bends

   a) The radius of bends shall be a minimum of 2% times the pipe diameter unless specified otherwise.

   b) Bends may be welded to adjacent pipe sections.

   c) Bends shall conform to the following table:

2-piece	0° to 30°
3-piece	30° to 45°
4-piece	45° to 67°
5-piece	*67°* to *90°*

C. Pipe Design. Steel pipe wall thickness shall per AWWA Manual M11

f_s = is not to exceed 16500 psi nor 50% of the specified minimum yield strength of the steel used in the cylinder.

D. Shop Quality Control.

1. Prior to start of manufacturing or fabricating, submit for approval Pipe Manufacturer's or Fabricator's Quality Control Plan that outlines the minimum requirements and test methods that meet these Contract Documents and the referenced standards.

2. Submit Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR) for approval that conform to these project requirements and specifications and to the referenced AWWA, ASME, and AWS codes and regulations.

3. Pipe Manufacturer's Welding Quality Control Representative: Submit name and phone number with list of relative experience of pipe manufacturer CWI (Certified Weld Inspector) quality control representative proposed for project for ENGINEER review and approval. CWI representative shall either be directly employed by pipe manufacturer or from an independent third (3rd) party CWI inspection type firm and shall be responsible for review, supervision, and certification of pipe manufacturer's or fabricator's fabrication and welding quality control inspection program.

4. The pipe manufacturer shall provide the OWNER's representative with copies of all written quality control procedures, equipment certification, tests and reports, as required by the Contract Documents and employed by the pipe manufacturer's or fabricator's quality control testing during production, fabrication, and coating and lining of the pipe and fittings.

5. Inspections: All pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of ANSI/AWWA C200 and ANSI/AWWA coating and lining standard as supplemented by the requirements of these Specifications.

6. Tests: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of ANSI/AWWA C200 and ANSI/AWWA coating and lining standards.

7. The Contractor shall perform said material tests at no additional costs to the Owner. The Engineer shall have the right to witness all testing conducted by the Contractor provided that the Contractor's schedule is not delayed for the convenience of the Engineer.
8. Welding Requirements: All welding procedures used to fabricate pipe shall be qualified under the provision of ANSI/AWS B2.a or ASME Sec. IX. Welding procedures shall be required for, but not limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

9. Welder Qualifications: All welding shall be done by skilled welders, welding operators and tackers who have had adequate experience in the methods and materials to be used. Welders shall maintain current qualifications under the provisions of ANSI/AWS B2.a or ASME Sec. IX Machines and electrodes similar to those in the work shall be used in qualification tests. The Contractor shall furnish all material and bear the expense of qualifying welders.

10. Welding and Fabrication Quality Control Supervision Qualifications: All welding and fabrication quality control inspections shall be performed by or under the direction of a Certified Welding Inspector (CWI) with approved procedures by AWS or ASME certified welders. This CWI shall be employed full time by the pipe manufacturer and shall either conduct the testing or have a supervisory position over the quality control weld and non-destructive test inspectors performing the work. If a CWI is not employed by the pipe manufacturer or fabricator then an independent third (3rd) party CWI inspector shall be employed/contracted by the pipe manufacturer or fabricator to serve in this capacity for the duration of the welding and fabrication process for the entire project.

11. The CWI shall certify/stamp that all quality control fabrication and weld inspection results are accurate, were performed in accordance with the referenced standards, and meet these specifications and the referenced code requirements. The CWI shall review in-house quality control test documentation and provide a signed stamped certification in letter format, as such, on a monthly basis for all invoiced pipe and fabricated pieces.

12. Conduct production run weld set of weld tests per AWWA C200 consisting of a minimum of one (1) root, one (1) face welds and two tensiles at a maximum of every 3,000 lineal feet of pipe for each size, grade, and thickness of pipe by each welding machine and operator.

13. If any production run weld inspection test fails, then increase testing frequency in accordance with AWWA C200.

14. On all pipe 24-inch and larger, all welds shall be one-hundred percent (100%) visually inspected by a CWI inspector as defined by AWS QC1. Acceptance standard shall be in accordance with AWS D1.1, Table 6.1 or ASME UW-35 and UW-38.

15. All welds made after hydrostatic testing shall be magnetic particle tested in accordance with ASTM E709. Acceptance criteria shall be in accordance with ASME Section VIII, Appendix 6 for magnetic particle type testing.

15110.2 MATERIALS

15110.2.1 A. Types of Steel Pipe

1. Cement mortar lined and polyurethane coated steel pipe (CML-PU). This type of pipe is to be used in steel pipeline construction unless otherwise specified.

B. Pipe Class or Working Pressure shall be 241 (AWWA M11) psi unless otherwise specified.

C. Nominal Pipe Diameter shall mean the approximate inside diameter of the cement mortar lining.

D. Fabricated Steel Plate Specials, defined as bends, wyes, reducers, outlets, and other pipe structures.

15110.2.2 QUALITY ASSURANCE

Includes the requirements of this specification and the requirements of the latest revision of the following standards as applicable. Unless specifically stated otherwise, the most stringent requirement will govern when there is a conflict.

A. AWWA C-200. American Water Works Association (AWWA) C-200 standard for steel water pipe 6 inches and larger.

B. AWWA C-222-18. AWWA C-222-18 Polyurethane Coatings and Linings for Steel Water Pipe and Fittings.

C. AWWA C-205. AWWA C-205 cement mortar lining and coating.

D. AWWA C-208. Standard dimensions for steel water pipe fittings.

E. AWWA C-303. Reinforced concrete pressure pipe -steel cylinder type, pre-tensioned.

F. ASTM C-150. Portland Cement.

1. Type II Cement.

2. Type V Cement.

G. ASTM A-234. Piping fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures.

H. AWWA Manual M-11. Design and installation of steel pipe.

I. ASTM 0-2240. Rubber property -durometer hardness.

For all steel manufactures, the Contractor shall submit to the Engineer, for approval, a certified letter stating that the steel meets or exceeds the following: all of the requirements of AWWA C-200, the applicable ASTM Standards, and this Specification, and provide certified physical and chemical test results. The manufacturer of the steel cylinder shall be responsible for all requirements of these specifications. Pre-approved manufacturers are: Continental Pipe Manufacturing Co., Mid America Pipe, Northwest Pipe Company and Rosco Moss. Other manufactures will be considered if requested in writing to the Engineer prior to the pre-bid meeting.

A. Cement Mortar Lined Steel Pipe Cylinder

1. Steel thickness shall be 0.250”.

J. Steel thickness shall be determined from the pressures imposed (Class) and the design stress of the steel. Design stress is defined as one-half (1/2) of the allowable minimum yield stress of the

steel. Pipe will experience a maximum working pressure of 155 psi plus a surge potential based on a 5 fps instantaneous stoppage.

2.

3. Steel pipe shall conform to the following table which includes minimum diameters and minimum thicknesses for various classes and nominal diameters. Note: Plate thickness is based on steel with a yield stress of 33,000 psi and a design stress equal to 50% of the yield stress (16,500 psi).

Nominal Pipe Diameter	Minimum Cylinder Diameter	Class 200 Min. Cylinder Plate Thickness	Class 150 Min. Cylinder Plate Thickness	Class 100 Min. Cylinder Plate Thickness
4"	4-1/2"0.0.	0.1046"	0.1046"	0.1046"
6"	6-5/8"0.0.	0.1046"	0.1046"	0.1046"
8"	8-5/8"0.0.	0.1046"	0.1046"	0.1046"
12"	**12-3/4"0.0.**	**0.1046"**	0.1046"	0.1046"
14"	15-1/4"0.0.	0.1046"	0.1046"	0.1046"
16"	17-3/8"0.0.	0.1046"	0.1046"	0.1046"
18"	19-3/8"0.0.	0.1160"	0.1046"	0.1046"
20"	21-3/8"0.0.	0.1280"	0.1046"	0.1046"
21"	22-3/8"0.0.	0.1340"	0.1046"	0.1046"
24"	25-3/8"0.0.	0.1519"	0.1143"	0.1046"
27"	28-3/8"0.0.	0.1699"	0.1278"	0.1046"
30"	**31-3/8"0.0.**	**0.1879"**	0.1413"	0.1046"
33"	34-3/8"0.0.	0.2058"	0.1548"	0.1046"
36"	37-3/8"0.0.	0.2238"	0.1684"	0.1126"
39"	40-3/8"0.0.	0.2418"	0.1819"	0.1216"
42"	43-3/8"0.0.	0.2597"	0.1954"	0.1306"
45"	46-7/8"0.0.	0.2807"	0.2111"	0.1412"
48"	49-7/8"0.0.	0.2987"	0.2247"	0.1502"
54"	55-7/8"0.0.	0.3346"	0.2517"	0.1683"

4. Cylinder shall conform to AWWA C-200.

5. Cement mortar lining shall conform to AWWA C-205.

6. Separate joint rings, if used, shall conform to Section 2.6, AWWA C-303.

7. Cement mortar lined steel pipe shall be polyurethane coated unless specified otherwise.

   a) Polyurethane Coating

      (i) Dry film thickness shall be a minimum of 60 mils thick.

      (ii) Holiday Tested

      (iii) At welded joints shall be profiled with mastic, tape wrapped and sleeved with a heat shrink sleeve such as the Premier Shrink Sleeve 60

or equivalent two part system such as Canusa Aqua Shield AQW-HS/AQW-WAB or engineer approved equal.

b) Field painting shall be used on above-ground installation as shown on the drawings

c) Bare metal shall be coated with a suitable primer for its intended use.

B. Steel Plate Specials

1. Shall be constructed of steel plate, thickness computed from the greater of the following criteria, unless a still greater requirement is shown on the drawings or stated in the special conditions:

a) Thickness not less than 3/16"; or

b) Thickness as determined from the formula

$$T \geq \frac{DxP}{2x16{,}500}$$

Where:
T = wall thickness in inches
D = inside diameter of steel cylinder in inches
P = design pressure (class) in pounds per square inch

2. Schedule 30 or heavier steel pipe in standard diameters may be used in lieu of above paragraph "2.01, D1" for outlets that are 12" and smaller diameter (12.75", 10.75", 8.625", 6.625" and 4.5" outside diameters).

3. Steel welding fittings conforming to the requirements of ASTM Designation A-234 may be used when available in suitable sizes.

4. Cement mortar lining meeting AWWA C-205.

5. Coating meeting the requirements of straight pipe.

6. Stiffner plates, when required, designed per the nomograph method of AWWA Manual M-11.

7. Reinforced steel collar pads designed for the specified pressure where needed.

8. Materials meeting or exceeding AWWA C-200 requirements

15110.2.3 MIXES

All mixes shall conform to the applicable reference sections.

15110.2.4 FABRICATION OF PIPE

A. Steel cylinder pipe shall be fabricated in accordance with:

1. AWWA C-200 for cement mortar lined steel pipe.

2. Polyurethane Coatings for Interior and Exterior of Steel Water Pipe and Fittings (AWWA C222)

B. Cement mortar lining process shall be followed with sealing each pipe end with a waterproof cover prior to carefully moving the pipe section. The pipe sections shall be cured under sprinklers or by other processes approved by the Engineer.

C. Coatings shall be applied after the exterior of the pipe is thoroughly cleaned and free from all loose mill scale and rust. Shop surface preparation shall be to SSPC-SP-5 with an angular profile as recommended by the manufacturer. The coating supervisor shall have 3 years of experience applying the coating to similarly sized pipe and hold amanufactures application certificate.

1. Polyurethane coatings: Shall be DuraShield 110 or approved equal

a) Shall be applied after pipe is fabricated and hydrostatically tested.

b) Shall have a minimum adhesion of 1,200 psi.

(i) Shall be applied to clean-dry surfaces to produce a suitable bond between the metal and subsequent coating of polyurethane.

(ii) Shall be uniform and free from bare spots and meet minimum thickness requirements.

(iii) Shall be applied in a single application to achieve the required dry film thickness.

c) A qualified Manufacturer's Technical Representative shall instruct and train Contractor's crews in proper application of the joint coating materials for lap-welded, and buttstrap joints. Training shall include steel surface preparation, correct sleeve application procedures, methods of determining the need for repair of damaged or incorrectly installed sleeves, and rejection, removal and replacement criteria and procedures.

d) Wax Tape Wrap: The wax tape wrap used at fittings, valves, and appurtenances shall be "Wax-Tape #1 Non-Firming Anti Corrosion Wrap" by Trenton or approved equal. Required primer shall be approved by the manufacturer. The "Outer Wrap" shall be supplied by the same manufacturer.

e) Coating and wrapping shall be omitted at each end for a sufficient distance to permit the making of field joints. All exposed bare metal shall be coated with a suitable primer.

D. Joints

1. Steel pipe joints shall be restrained welded lap joints per AWWA C206.

a) The steel area in the bell shall not be less than the area in an equivalent length of pipe barrel.

b) The standard bell shall provide a 3-inch lap. The bell shall provide for a minimal engagement of 1-inch or four times the thickness of the bell.

c) Where pulled joints cannot achieve the required deflection the weld bell will be miter cut before forming allowing up to 5 degrees of deflection.

d) Shop applied lining and coatings shall be held back to allow for welding of the joint.

e) Welding of closure joints shall occur during the coolest part of the day. Pipe shall be shaded by backfill to control thermal expansion. Un-backfilled joints may be shaded by awnings or tarps prior to welding. Witness marks shall be observed prior to welding the final joint to verify sufficient insertion.

f) Prior to the beginning of the welding procedure, any tack welds used to position the pipe during laying shall be removed. The weld shall then be made in accordance with AWWA C206. As soon as practicable after welding of each joint, all field welded joints shall be tested by the liquid penetrant inspection procedure conforming to the requirements of ASTM E 165 under Method "B" and "Leak Testing." All defects shall be chipped out, rewelded and retested. Upon retest, the repaired area shall show no leaks or other defects. Hydrostatic testing will still be required. Other alternative tests shall be approved by the Engineer.

g) Following tests of the joint, the exterior joint spaces shall be profiled with mastic and coated with heat shrinkable sleeves per AWWA C216 and manufacturer's recommendations or cold applied tape conforming to AWWA C209 . The thickness of the heat shrinkable sleeve shall be 60 mil minimum, or as recommended by the sleeve manufacturer, whichever is greater. The cold applied tape shall consist of two wraps of 35 mil tape for a total thickness of 60 mils. The interior linings shall be repaired with cement mortar per AWWA C205 Special Provisions and Specifications. Adequate space shall be provided for welding and inspection of the joints.

Flanged Joints are be required at various locations to accommodate necessary valves, fittings and connections as shown on the drawings. The Contractor shall verify and match flanged ends. Joints shall conform to AWWA C200 and AWWA C207. Flanges shall have a pressure rating equal to or greater than that of the pipe. Flanges located within the pump station and downstream of the pump station on the steel pipe shall be ANSI Class 300. Flanges upstream of the pump station may be ANSI Class 150.

Flange faces shall be shop coated with a soluble rust preventive compound. All buried flanges shall be coated by a shop applied epoxy coating. Gaskets shall be full-face and furnished in accordance with AWWA C207 and shall be rated to the required design pressure. Bolts for flanges located indoors and in enclosed vaults and structures shall be Type 316 stainless steel. Bolts for buried and submerged flanges and flanges located outdoors above ground or in open vaults in structures shall be Type 316 stainless steel. Carbon steel nuts shall be used in conjunction with anti-seize compound applied to the threads. Bolts and nuts shall conform to AWWA standards.

2. Ends including but not limited to weld bells, plain ends, and butt straps shall conform to AWWA C-200 where applicable, and to the construction drawings.

D. Steel Plate Specials shall conform to approved shop drawings and shall be fabricated in a shop approved for that purpose by the Engineer.

1. Each special shall have a mark on the top and bottom corresponding to the true vertical axis.

2. Outlets, including wyes, shall be built into the wall of the pipe.

3. Fabricated steel fittings of suitable design shall be welded to the cylinder before the exterior coating is placed around the fittings.

4. Cement mortar lining shall meet the requirements of straight pipe with the provisions that handwork lining reinforcement shall be positioned approximately in the center of the lining. The wires spaced 2" on center shall extend circumferentially around the pipe. The fabric shall be securely fastened to the pipe. Splices shall be lapped 4" and the free ends tied or looped to ensure continuity.

15110.3 CONSTRUCTION REQUIREMENTS

151103.1 DELIVERY

Pipe and material shall be furnished, delivered and strung along the trench site.

A. Internal bracing adequate for handling and transportation shall be installed as soon as practical after the application of cement mortar lining. All bracing shall remain in the pipe until installation and backfilling are completed.

B. Gasket, wax tape and wrap material shall be furnished with the pipe for storage in a cool, well ventilated place and protected from direct sunlight.

C. Pipe, and fittings shall not be placed directly on rough ground but shall be supported in a manner that will protect the pipe against injury whenever stored at the Site or elsewhere.

D. The CONTRACTOR shall inspect each pipe, special, and fitting for damage. No pipe shall be installed when the lining or coating, or interior or exterior surfaces show cracks that may be harmful as determined by the ENGINEER. Such damaged lining and coating, and interior and exterior surfaces shall be repaired or a new undamaged pipe, special, or fitting shall be provided. The contractor shall mark as rejected and immediately remove from the jobsite, or repair to the Owner's satisfaction, all pipe lengths exhibiting signs of damage to the lining, coating, joints, or pipe wall.

E. Pipe ends and fittings shall be cleaned of foreign materials and kept clean during installation. Pipe ends and openings shall also be covered or otherwise closed to prevent entry of water, rodents, dirt during any stoppage or interruption of the work.

151103.2 JOB CONDITIONS

Pipe and materials shall not be fabricated, stored, or installed in climatic conditions that will adversely affect the quality of the finished pipeline project.

151103.3 ALTERNATIVES

Steel pipe shall conform to AWWA C200 for cement mortar lined and polyurethane coated pipe.

151103.4 INSPECTION

A. Notification of Manufacture. Unless specifically waived, Engineer shall be notified at least 48-hours prior to commencement of the manufacture of pipe.

B. Hydrostatic Testing. Steel cylinders shall be hydrostatically tested to a stress equal to 75% of the minimum yield point of the steel. Certification of all cylinders is required by the Engineer.

C. Specials. Specials shall be bulkheaded and tested prior to lining and coating of weld seams at one-and-one-half (1 1/2) times the design pressure (class). Dye penetrant process may be used on all untested welds in lieu of hydrostatic testing if the straight pipe used in fabricating the special has passed a hydrostatic test of 75% of the yield point. All defective welds including pinholes and porous welds shall be chipped out, re-welded, and re-tested.

D. Soap and Compressed Air Test

1. All double-welded lap joints, butt-strap joints, and other joints susceptible to this test shall be tested by the soap and compressed air method as hereinafter described. After completion of the shop hydrostatic test of the pipe sections the soap and compressed air test also may be used instead of hydrostatic testing of welded joints in the steel manhole outlets, which are attached to steel-plate sections.

2. As soon as practicable after the welding of each joint to be tested by the soap and compressed air test has been completed, the Contractor shall subject each joint to a soap test by forcing compressed air, at approximately 40 pounds pressure per-square-inch, into each said joint and, while the joint is under pressure, every portion of every welded seam forming a part of the joint shall be swabbed with a heavy soap solution or an approved, commercial, bubble producing leak test fluid and shall be carefully examined for leakage. The Contractor shall repair any defects disclosed by the test by chipping out and re-welding the chipped section, after which the same test shall again be applied. The Contractor shall provide all apparatus and materials for making the tests, and shall drill and tap the necessary holes, and shall plug weld the holes after testing.

E. Manways. All 30" diameter and larger pipe shall have 24" diameter or larger access manways within 750 feet of any interior point of the pipeline.

1. Manways shall consist of 30" diameter outlets with 30" blind flanges.

2. Manways shall have a maximum spacing as shown on the drawings.

3. Outlets or bumped heads that provide an equal or larger opening than a 24" manway may be used for pipe access.

4. Manway locations shall be selected to minimize impact to traffic, and shall be approved by JPWB prior to pipe fabrication if different than plan location.

151103.5 INSTALLATION

A. Preparation. Internal bracing, in addition to the bracing used for handling and transportation of the pipe, shall be installed when required to ensure maximum permissible deflections are not exceeded during laying, backfill, and compaction.

1. Pipe, specials, and fittings shall be laid directly on the imported bedding material.

2. No blocking will be permitted, and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe, special, or fitting.

3. Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings.

4. Excavation outside the normal trench section shall be made at field joints as needed to permit adequate access to the joints for field connection operations and for application of coating on field joints.

B. Test Section At the beginning of pipe laying operations, the CONTRACTOR shall perform a test section to demonstrate that the methods and materials to be used will satisfy the pipe zone backfill compaction and pipe deflection criteria. The maximum length of the test section shall be 500 feet. The ENGINEER will observe construction of the test section. The CONTRACTOR shall not proceed with production pipe laying beyond the test section without the ENGINEER's approval.

C. Alignment and grade.
Where necessary to raise or lower the pipe, specials, or fittings due to obstructions or other causes, the ENGINEER may change the alignment and/or the grade. Such change shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings, although in no case shall the deflection in a joint exceed 75 percent of the maximum deflection recommended by the pipe manufacturer. The contractor shall pothole potential utility conflicts with sufficient advance to allow grade changes by pipe joint defection to avoid additional fittings and rework or to identify needed additional fittings.

D. Pipe Zone Density. Relative compaction in pipe zone shall be in accord with the manufacturer's recommendation. All pipe bid for this project shall meet JPWB's minimum standards as set herein.

E. Welding. Prior to beginning the welding procedure, any tack welds used to position the pipe during laying shall be removed. Any annular space between the faying surfaces of the bell and spigot shall be equally distributed around the circumference of the joint by shimming, jacking, or other suitable means. Prior to butt welding, the pipe and joint shall be properly positioned in the trench using line up clamps so that, in the finished joint, the abutting pipe sections shall not be misaligned more than 1/16 inch. Where more than one pass is required, each pass except the first and final ones shall be peened to relieve shrinkage stresses, and dirt, slag, and flux shall be removed before the succeeding bead is applied. Field welded joints shall be in accordance with AWWA C206 Field Welding of Steel Water Pipe. A heat resistant shield shall be draped over at least 24 inches of coating beyond the holdback on both sides of the weld during welding to avoid damage to the coating by hot weld splatter.

F. Backfilling. After the pipe and joint are properly positioned in the trench, the length of pipe between joints shall be backfilled to at least one foot above the top of the pipe. Care shall be exercised during the initial backfilling to prevent movement of the pipe and to prevent any backfill material from being deposited on the joint.

G. Temperature Stress. To control temperature stresses, the unbackfilled joint areas of the pipe shall be shaded from the direct rays of the sun by the use of properly supported awnings, umbrellas, tarpaulins, or other suitable materials for a minimum period of 2 hours prior to the beginning of the welding operation and until the weld has been completed. Shading materials at the joint area shall not rest directly on the pipe but shall be supported to allow air circulation around the pipe. Shading of the pipe joints need not be performed when the ambient air temperature is below 45 degrees F.

H. Control Joints. At intervals not exceeding 250 feet along welded reaches of the pipeline and at the first regular lap welded field joints outside concrete encasements and structures, the pipe shall be

laid with an initial lap of not less than one inch greater than the minimum lap dimension. The welding of each such shrinkage control joint shall be performed when the temperature is approximately the lowest during the 24 hour day, after at least 250 feet of pipe have been laid and the joints have been welded ahead of and in back of the shrinkage control joint, and after backfill has been completed to at least one foot above the top of the pipe ahead of and in back of the shrinkage control joint.

I. Inspection of Welds. An independent testing laboratory acceptable to the ENGINEER but paid by the CONTRACTOR shall inspect the joints. Butt welds shall be inspected by radiographic methods in accordance with API Standard 1104. Following tests of the joint, the exterior joint spaces shall be coated as indicated, after which backfilling may be completed. Defective welds shall be repaired by the CONTRACTOR to meet the indicated requirements. Defects in welds or defective welds shall be removed, and that section of the joint shall then be re-welded. After the repair is made, the joint shall be checked by repeating the original test procedure. Welds deficient in size shall be repaired by adding weld metal.

J. Exterior Coating Prior to shrink sleeve placement, a prime coat followed by tape wrap shall be applied to the welded joint and adjoining hold back areas. The cured heat shrink sleeve shall extend a minimum of six inches onto the adjoining factory applied polyurethane coating.

1. The joint area and adjacent factory applied coatings shall be solvent cleaned to remove contaminants in in accordance with SSPC-SP1.

2. The sleeve shall be heated to manufacturer's recommended application temperature. The length of the sleeve shall account for shrinkage and insure adequate (6-inch) cured overlap onto the factory applied coating.

3. The application of the sleeve shall insure removal of air bubbles and wrinkles with roller or gloved hand to confirm there is uniform shrinkage and adhesion to the factory applied coating.

4. The installed shrink sleeve shall be tested for holidays with a high voltage spark testing and any identified defects shall be repaired and retested in similar fashion.

5. Bubbles, gouges and scrapes in the coating shall be removed and repaired per the manufacturers written instructions.

K. Mortaring Operations shall begin after any pipe installation operations that could stress, de-bond or otherwise damage the new mortar have been completed. Mortaring shall follow AWWA C205 using NSF 61 approved products.

1. The interior joint mortaring operation should occur after placement, backfill and compaction of the pipe have been completed and the active pipe laying is at least 120 feet away.

2. The factory applied coatings shall also be inspected and repaired as necessary during the mortaring process.

3. All joints shall be measured on the interior to confirm roundness is withing less than 1-inch difference between horizontal and vertical measurements.

4. The surface to be grouted shall be cleaned with a wire wheel to remove any scale, slag or dirt prior to application of the epoxy bonding agent.

5. All mortar patches shall be applied per manufacturer recommendations and smoothed to the contour of adjoining masonry surfaces. Feathering the mortar onto existing surfaces is not allowed.

L. Field Testing. The pipeline shall be hydrostatic tested in accordance with AWWA C-200. Perform hydrostatic pressure test in the presence of the Engineer or appointed field representatives of the owner and Engineer. Hydrostatic test shall have either an independent chart recorder that continuously records pressures and time or an independent pounds square inch (PSI) gauge measured by Operator and recorded on individual data sheets. Monitor hydrostatic test daily chart logs or test data sheets to verify that specified hydrostatic test pressure and time requirements were met with no leakage. The Contractor shall provide all necessary piping between the reach being tested and the water supply, together with all required materials and equipment including dished heads, blind flange or bulkheads as necessary to isolate and test pipeline. The contractor shall provide for proper legal disposal of test water.

M. Tape Coating Appurtenances Valves and Flanges. Each pipeline valve and flanged connection shall be bonded with the pipe and from pipe to pipe prior to the coating process. Any valve, flange, fitting, appurtenance or special fabrication without a shop applied polyurethane coating shall receive an additional wax tape wrap protection(including the ductile fittings on the PVC pipeline section).

1. Wax tape shall be a non-firming Wax Tape #1 by Trenton or approve equal.

2. Manufacturer supplied primer shall be applied after wire brush preparation before application of the tape. Primer shall be rubbed as needed to displace and moisture on the pipe surface.

3. Tape shall be applied in overlapping fashion such that a double layer of tape is created. Care shall be taken to lay the tape flat and free of air pockets and wrinkles. Use profiling mastic as required in areas where the tap will not adhere to the primer.

4. A “Guard Wrap” outer wrap shall be installed over the wax tap wrap.

5. Manufacturer’s Technical Representative shall be present on the first wrap to instruct and train Contractor’s crews in proper application of the joint coating materials for flange joints, including at butterfly valve locations. Training shall include steel surface preparation, correct tape application procedures, methods of determining the need for repair of damaged or incorrectly installed tape, and rejection, removal and replacement criteria and procedures. The Technical Representative shall not leave the project until the Engineer and Contractor agree that Contractor’s crews are adequately trained in tape wrap applications.

6. The Technical Representative shall prepare a report of the site visit. The report shall be signed by the representative and shall include instruction provided and any pertinent job specific action items. Copies of the reports shall be submitted to the CONTRACTOR for review and coordination by the CONTRACTOR of any actions required. Copies shall also be provided to the ENGINEER.

15110.4 METHOD OF MEASUREMENT

Measurement of this pipe shall be made by the lineal foot of pipe installed, welded, grouted, bedded, coated, bonded and backfilled under the following basis of payment items. No separate measurement will be made for fittings, bends or tees that are part of other structures such as the pump station, manways, air release valves or blowoffs.

15110.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
30" ID Poly Coated CM lined Steel Pipe 0.250 Wall 36 ksi	L.F.
30" Pipe Installation, Grouting, and Poly Wrap Joints	L.F.
Fabricated Steel Bends	Each
Fabricated Steel Tee 30x12	Each

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CATHODIC PROTECTION SYSTEM — SECTION SP15111

15111.1 GENERAL

15111.1.1 SUMMARY

A. The new water transmission line will be protected by an impressed current system on the steel pipe and a sacrificial anode system on the casing pipe and ductile iron fitting on the PVC sections of the pipe. The components of the impressed current system will be:

1. (1) ground bed.
2. (1) Impressed current rectifier.
3. A series of test stations for cathodic protection monitoring purposes.
4. Sacrificial anodes to provide cathodic protection to the casings under I-80 and Foothill Blvd and provide additional protection to the carrier pipeline while inside the casings.
5. Sacrificial anodes to provide protection to the ductile iron fittings on the PVC pipeline located north of the pump station.
6. Bonding cables and straps to ensure that the entire pipeline is electrically continuous.

The rectifier shall supply current to the steel suction line south of the pump station and the steel transmission line north of the pump station. The rectifier shall be located at the pump station.

The ground bed shall be based on a soil resistivity of 1,000 Ohms per square centimeter.

15111.2 PRODUCTS

15111.2.1 MATERIALS

A. ANODE GROUND BED

1. ANODES – The anodes shall be 32 lb high potential magnesium anodes with #10 AWG, TW THHN solid copper wire leads.
2. COKE BREEZE – Acceptable cokebreeze will be SC-3 as produced by Loresco, Inc. No substitutes will be allowed unless approved by Engineer.
3. JUNCTION BOX – The anode junction box with a terminal for each anode and a shunt for each circuit will be galvanized. An acceptable junction box is manufactured by Integrated Rectifier Technologies or approved equal.

B. RECTIFIER – The rectifier should be a model ADASFS 24-12 GH as manufactured by Integrated Rectifier Technologies or approved equal.

C. RECTIFIER MOUNT – The rectifier shall be mounted on the east exterior gable end of the pump station and secured to the masonry wall.

D. TEST STATIONS – A Blue T-3 test station head will be mounted on a 3” poly pipe and attached to a steel marker post with 3” offsets. The offsets shall be either unistrut or welded angle iron. The steel pipe will be pre-blasted and powder coated Blue before attaching the test station. The test station will be 3- 1/2’ above ground and have a 2’ concrete base. Acceptable test head and pipe are manufactured by Tinker & Rasor or approved equal.

E. SACRIFICIAL ANODES – The hi-potential anode will be size specific as required and will be as manufactured by MESA Products or approved equal.

F. JOINT BONDS - A #2 HMWPE X 18” joint bond cable with sleeves and / or a 1/16” x 1-1/4”

X 18" copper bar strap with a hole punched at each end will be required to make a bond between pipe connections where specified. Straps and joint bond wires are available from WBI Energy Corrosion Services or equal.

G. PERMANENT REFERENCE CELLS – The permanent reference cells will be the Stealth model SRE-007-CFY from Borin Manufacturing or approved equal.

H. EXOTHERMIC WELD CAP – The weld cap will be 4" X 4" in dimension. It will be made up of a corrosion resistant compound, elastomeric adhesive and integrated primer. Acceptable caps include the Chase Corp Handy Cap IP or approved equal.

I. CP TEST STATION (FLUSH MOUNT) – A flush mounted, traffic approved test station with a cast iron lid that is locking and has a plastic pipe shaft 18" in length. A 4 point connection should be available as needed. An approved product is a CP Mini test station as distributed Handley or approved equal.

J. WIRE CODE

1. PIPELINE TEST LEADS – The pipeline test leads are to be # 12 stranded copper with blue THHN coating.
2. SACRIFICIAL ANODE LEADS – The sacrificial anode leads are to be #12 stranded copper with black THHN coating with 3M 35 red tape on the ends.
3. PERMANENT REFERENCE CELL LEADS - The permanent reference cells will have #14 yellow wires.
4. COUPON LEADS - The wires are to be #12 stranded copper wires with green THHN coating.
5. CASING TEST LEADS – The casing test leads are to be #12 stranded copper wires with black THHN coating.
6. POSITIVE CABLES – The positive cable will be stranded #4 copper wires with HMWPE coating. The cable will be black with red tape on the ends.
7. NEGATIVE CABLES – The negative cables will be stranded #4 copper wires with HMWPE coating. The cable will be black.

15111.3 EXECUTION

15111.3.1 GENERAL

A. The cathodic protection components shall be constructed at the locations shown on the plans, and where directed by the ENGINEER, and shall be in accordance with these specifications and plans.

15111.3.2 GROUND BED

A. The ground bed shall be installed by the cathodic protection subcontractor. All of the materials for the ground bed shall be procured by the same. The ground bed will consist of a series of six 20 ft deep 10-inch holes. The holes will be filled with the graphite anodes and then filled with coke breeze backfill. The cables will extend from the ground bed to the junction box, then a cable (the positive cable) will extend to the rectifier. There will also be a cable (the negative cable) that connects the rectifier to the pipeline.

B. The rectifier will be mounted on a 10' long steel pipe, 6" in diameter and set in concrete. The pipe will be powder coated blue to match the test stations. Refer to the Cathodic Protection detail

9 for rectifier installation. This work will be completed in full by the cathodic protection contractor.

C. The AC power will be supplied to the rectifier ground bed site, and wired into the rectifier by the CP subcontractor according to local code.

D. All required cable trenching and backfilling will be completed under the direction of the cathodic protection subcontractor. The cathodic protection cables will be installed at a depth of 24". The cables shall be backfilled with native soil, unless the native soil contains excessive rock as determined by the CP subcontractor. Any excess soil is to be removed from the location.

E. The final connection to the pipeline will be made by the pipeline contractor at the time of pipeline installation. Refer to Cathodic Protection Detail 1 for negative cable connection details.

F. The junction box will be installed on the side of building near the rectifier.

15111.3.3 TEST STATIONS

A. Test station installation and wiring will be completed by the CP subcontractor. Coordination will be needed between the pipeline contractor and the CP subcontractor to complete the installations.

B. The test stations are used to monitor the effectiveness of the cathodic protection system. All test station materials and installation shall be completed by pipeline contractor.

C. The test stations are to be constructed of a Tinker and Rasor T3 test station or Engineer approved equal. The test head shall be blue. The test station shall be mounted on a 4" steel pipe. The steel pipe shall be powder coated in blue to match the test station head. Upon installation, the bottom 2' of the steel pipe and test station shall be set in a concrete footer. All cables that are routed into the test station must be installed below the concrete footer or collar.

D. Flush mount test stations will be used where above grade features are not feasible. The flush mount test stations will be set in concrete, flush with the existing grade.

15111.3.4 SACRIFICIAL ANODES

A. Sacrificial anode installation and wiring will be completed by the cathodic protection subcontractor.

B. Sacrificial anodes will be used to provide protection to the casings. There will be two types of sacrificial anodes used on this project. The first type of sacrificial anode will be the prepackaged block style for the casings. The second type will be the linear ribbon anode and will be installed inside the casing attached to the casing at about the 7-OClock or 5-OClock position.

C. The sacrificial anodes for the casing shall be installed by the cathodic protection subcontractor, and wired into the test stations as shown on CP-4. The pipeline contactor will provide the necessary excavations and backfill for the placement of the anodes. It will be necessary to coordinate with the CP subcontractor for the installation of the anodes.

D. The sacrificial anodes for the carrier shall be installed by the pipeline contractor, with the help of the onsite cathodic protection contractor. The anodes will be directly connected to the carrier at intervals convenient for construction, but not to exceed 100' intervals. CP subcontractor will build the anode ribbon in the desired lengths for the contractor prior to the start of the bored segments as directed by the pipeline contractor. The mag ribbon will extend for the entire casing length.

15111.3.5 JOINT BONDS

A. The pipeline contractor will be responsible for the procurement and installation of the joint bonds. The pipeline will require joint bonds to ensure that the entire pipeline is electrically continuous. Joints bonds are welded across any mechanical connection along the pipeline. All inline fittings and non-welded pipeline joints will require the installation of joint bonds. Two different styles of joint bonds will be used on this project.

1. FITTINGS

a. All fittings that are not connected via weld connection are to have bonding cables installed. The #2 HMWPE stranded copper bonding cables will require A203 copper sleeves before thermite welding the connection to the pipeline.

15111.3.6 REFERENCE CELLS

A. Reference cells will be required for each casing. The reference cells will be placed as near as possible to the end of – and 18-inches below- the casing. See Detail B – D14.

15111.3.7 SYSTEM TESTING

A. The system testing is to be carried out by a competent person with a minimum NACE certification of CP Technician. All testing documentation shall be sent to a NACE certified CP Specialist for review and acceptance.

1. GROUND BED

a. The ground bed shall be tested for functionality as follows. Once the rectifier has AC power, the rectifier and ground bed should be energized and adjusted until the potential on the pipeline is near 1500 mV with respect to a copper copper-sulfate reference electrode. The current across the shunts in the junction box should be measured and recorded for each anode.

1) Passing test – Current will be passing through each shunt with the rectifier energized, indicating that all of the anodes are intact. The amount of current passing through each shunt should also be recorded and sent to the CP Specialist for acceptance.

2. TEST STATIONS

a. The test stations will be tested for proper wiring, proper color coding and functionality of the test leads.

1) Passing test – The test stations will be wired as the diagrams detail, the colors of the leads inside the test stations need to match the color codes in the specifications and the potential of the test leads should be more negative than -500 mV in respect to a copper copper-sulfate reference electrode.

3. SACRIFICIAL ANODES

a. Sacrificial anodes will be tested for proper open circuit potential where the test leads are routed into the test stations above ground.

1) Passing test – The open circuit potential of the sacrificial anodes will be between -2000 mV and -1500 mV in respect to a copper copper-sulfate reference electrode.

4. FITTING BONDS

a. If the fitting bonds were installed correctly, current will pass from one end of the pipeline to the other across the fitting. Once the pipeline is installed and the ground bed has been activated, an interrupted survey will be completed on the pipeline. The results of this survey will determine if all of the bonds are intact.

1) Passing test – The results of the interrupted survey will yield an "on" potential and an "off" potential. The difference between the "on" and the "off" is called the IR Drop. The IR drop should remain consistent from test station to test station along the line. If the IR drop becomes zero or substantially different from the remainder of the system as reviewed by a NACE certified CP Specialist, the bonds are not effective.

2) The pipeline contractor shall, at their own expense, test the integrity of each joint bond as they are installed with a Biddle meter as a failing continuity test during the interrupted survey will be the responsibility of the pipeline contractor to locate and remediate.

15111.3.8 SYSTEM ACTIVATION

A. GROUNDBED

1. Before activating the rectifier, the potentials should be obtained at all test stations and casings.
2. The rectifier and ground bed are to be energized on the lowest possible setting. The rectifier tap settings should then be adjusted up as needed until the potential on the pipeline is near 1500 mV with respect to a copper copper-sulfate reference electrode (cse).
3. The system should then be left to polarize for a period of at least 48 hours.
4. Once the system has polarized, an interrupted survey should be completed to obtain the "on " and "off" potentials. If the "off" potentials are not between -850 mV and -1200 mV CSE, the rectifier should be adjusted until the proper potentials are obtained.
5. Once all adjustments have been completed, a complete survey of the entire pipeline network will need to be completed as the new pipeline will be tied directly into the existing pipeline network. The complete survey will be an interrupted survey with all rectifiers in the network interrupting the current simultaneously.

B. SACRIFICIAL SYSTEMS

1. The native potentials need to be recorded on the carrier and casings before activating any of the sacrificial systems.
2. Wire the sacrificial anodes into the test stations and allowed to polarize a minimum of 48 hours.
3. Perform an interrupted survey on the casings to obtain the "on" and "off" potentials.

15111.4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

15111.4.1 METHOD OF MEASUREMENT

A. All work included herein to be performed with the pipe installation and will not be measured separately.

15111.4.2 BASIS OF PAYMENT

A. No separate payment will be made under this specification for work performed by the Pipeline Contractor. Compensation for work described herein will be considered to be included in the Bid Prices for Steel Water Pipe under Special Provision SP15110 Steel Cylinder Water Pipe

15120.1 DESCRIPTION

15120.1.1 The CONTRACTOR shall furnish and install all pipe, fittings, closure pieces, supports, gaskets, joining materials or other appurtenances as shown and specified for a complete and workable plant piping system.

15120.1.2 All pipe and fittings shall be of the type, class, and size designated on the DRAWINGS and as specified in these SPECIFICATIONS. All pipe, fittings, gaskets, solvent cements, and other items or materials installed in a pipeline containing water intended for culinary use shall comply with National Sanitary Foundation (NSF) Standard 61. Also, all plastic pipe must be approved by the NSF for potable water use and shall be stamped "NSF-PW" on the pipe indicating such approval.

15120.1.3 Piping shall be installed as indicated on the DRAWINGS. Pipe size and locations are provided, but the DRAWINGS are not intended to show every offset, fitting, or structural difficulty that may be encountered during project construction.

15120.1.4 Exposed piping shall not be erected until the all equipment to which the pipe is to be attached has been installed and it can be determined where the piping and fittings shall be located to make a neat, effective arrangement. Pipe runs shall be horizontal and vertical and installed in straight runs parallel the axis of the pipe chases.

15120.1.5 If the CONTRACTOR desires to change any of the piping layouts shown on the DRAWINGS, he shall submit to the ENGINEER, for approval, his detailed proposed layouts. Such approved changes shall come at no additional cost to the OWNER. The CONTRACTOR shall provide all materials and labor required to complete all WORK in accordance with the best practice of the trade, and to the satisfaction of the ENGINEER.

15120.1.6 RELATED WORK

Section 02200 – Trench Excavation & Backfill
Section 02224 – Sewerline Pipe & Manhole Installation
Section 05050 – Miscellaneous Metal
Section 15110 – Pipe & Piping Systems
Section 15230 – Water Valves
Section 15480 – Compressed Air Piping

15120.1.7 REFERENCES

15120.1.7.1 Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D2466 Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D2467 Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D2564 Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C 104 Standards for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C 110 Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. for Water and Other Liquids

AWWA C 111 Standard for Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

AWWA C 150 Standard for the Thickness Design of Ductile-Iron Pipe

AWWA C 151 Standard for the Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

AWWA C 600 Standard for Installation of Ductile-Iron Water Mains and their Appurtenances

AWWA C 651 Standard for Disinfecting Water Mains

AWWA C 900 Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. through 12 In.

AWWA C 905 Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 14 In. through 20 In.

AWWA C 907 Standard for Polyvinyl Chloride (PVC) Pressure Fittings

AWWA M 23 Manual of Water Supply Practices - PVC Pipe-Design and Installation

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16 Bolt Hole Pattern for Pipe Flanges and Flanged Fittings

15120.1.8 SUBMITTALS

15120.1.8.1 The CONTRACTOR shall submit for review complete information, showing all pipe, fittings, gaskets, solvent cements, and other appurtenant materials were manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed. All information shall be provided in accordance with Section 01300 and written evidence of compliance from the manufacturer shall be provided with each delivery of material.

15120.1.8.2 As construction proceeds, the CONTRACTOR shall submit test documentation in accordance with Section 15120.3.5 of these SPECIFICATIONS.

15120.2 MATERIALS

15120.2.1 POLYVINYL CHLORIDE PIPE (PVC) - All exposed plant piping shall be rigid thermoplastic pressure pipe meeting the requirements of ASTM D1785, Schedule 40 (unless otherwise specified), and of the size shown on the DRAWINGS.

15120.2.2 PVC FITTINGS - Fittings for PVC piping shall meet the requirements of ASTM D2466 and ASTM 2467, of the schedule and size shown on the DRAWINGS.

15120.2.3 THERMOPLASTIC FLANGES - Flanges for PVC piping shall be Van Stone style and of the size and type shown on the DRAWINGS. Flanges shall meet the requirements of ASTM D2467 and ASTM D4024.

15120.2.4 PVC SOLVENT CEMENTS- Solvent cements for PVC piping shall meet the requirements of ASTM D2564 and the National Sanitary Foundation (NSF) Standard 61.

15120.2.5 DUCTILE IRON PIPE (DI) - All buried plant piping shall be DI Pressure Class 300, meeting the requirements of ANSI/AWWA Standards C-150 and C151 with push-on, mechanical, or flanged joints as shown on the DRAWINGS. Unless directed otherwise on the DRAWINGS or in these SPECIFICATIONS, the interior surface of all DI pipe shall be factory coated with a standard coating of cement-mortar, which shall be further covered with a bituminous seal coat, all in accordance with ANSI/AWWA Standard C-104. Field coating of DI pipe will not be acceptable or allowed.

15120.2.6 DUCTILE IRON FITTINGS - Fittings for DI piping shall be push-on, mechanical, or flanged as shown on the DRAWINGS and shall meet the requirements of ANSI/AWWA C-110 with a standard factory coating of cement-mortar on all interior surfaces, which shall be further covered with a bituminous seal coat, all in accordance with ANSI/AWWA Standard C-104 on the interior surfaces. Field coating of DI fittings will not be acceptable or allowed. Pressure rating for fittings shall be as required to meet or exceed the pressure rating of the piping.

15120.2.7 DUCTILE IRON FLANGES - Flanges shall be the size, class, and fitted with gaskets, in accordance with the requirements of ANSI/AWWA C-110. Mating surfaces of all flanges shall be protecting against rusting. Class D, 150 PSI flanges with a rated working pressure of 250 psi shall be provided when not otherwise shown on the DRAWINGS.

15120.2.8 GALVANIZED IRON PIPE AND FITTINGS - Galvanized pipe and fittings shall be schedule 80 unless otherwise shown on the DRAWINGS and used only in exposed, non-corrosive atmospheres where piping diameters are less than 4 inches.

15120.2.9 GASKETS - Gaskets shall be full faced, 1/8 inch thick EPDM. Blind flange gaskets shall cover the entire inside face of the flange and shall be cemented in place. Gaskets shall be as manufactured by ASAHI America, Inc., or approved equal.

15120.2.10 BOLTS - ALL bolts, nuts, hardware, and fasteners for fittings, valves, and piping components shall be Stainless Steel, Type 316 unless specifically approved otherwise by the ENGINEER in writing.

15120.2.11 THREAD COMPOUND - All nut and bolt threads shall be coated with an anti-seize thread compound, Product 767, as manufactured by Loctite Corporation (860/571-5100), or approved equal.

15120.3 CONSTRUCTION REQUIREMENTS

15120.3.1 HANDLING AND REJECTION OF MATERIALS

15120.3.1.1 Care shall be taken during handling of pipe, to avoid impact which might cause damage. Dropping pipe during unloading will not be permitted.

15120.3.1.2 Pipe will be carefully inspected in the field before installation. If any cause for rejection is discovered in a pipe before or after installation, it shall be removed and replaced by the CONTRACTOR, at no additional cost to the OWNER.

15120.3.1.3 Any pipe found to be unfit or rejected due to cracks, broken bells or spigots, irreparable chipped lining, etc., shall be removed from the job site.

15120.3.2 INSTALLATION

15120.3.2.1 When making connections, pipe shall be cut in a neat and workmanlike manner, so as to provide a smooth end at right angles to the axis of the pipe. Pipe and fittings shall be assembled so there will be no distortion or springing of the pipelines. Fittings, flanges, and any other connections

shall come together at the proper orientation. The fit shall not be made by springing piping, nor shall orientation or alignment be corrected by taking up on any flange bolts. Flange bolts, mechanical joints, flexible connectors, etc., shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to make the fit meeting the above requirements.

15120.3.2.2 At the close of each work day, or whenever the work ceases for any reason, the end of the pipe shall be securely closed, unless otherwise permitted by the ENGINEER.

15120.3.2.3 Exposed piping shall not be installed until all equipment to which the pipe is to be attached has been installed and it can be determined where piping and fittings shall be located to make a neat, efficient arrangement. Piping shall be aligned with equipment connections such that no external load or stress will be transferred to any equipment from the piping. Pipe runs shall be horizontal and vertical and installed in straight runs parallel to the axis of the pipe chases. Piping shall be installed to allow for convenient inspection and maintenance.

15120.3.2.4 All piping shall be painted in accordance with Section 9910 of these SPECIFICATIONS and color coded according the following table. Identification of the direction of flow and the contained liquid or piping system (i.e. “Raw Water”, “House Water”, “Finished Water”, “Chlorine Gas”, etc.) shall also be made on the pipe. The color and type of paint used shall be submitted to the ENGINEER for his approval.

Color Scheme for Piping

Raw	Olive Green
Potable	Dark Blue
Backwash Waste	Light Brown
Sludge	Dark Brown
Natural Gas	Red
Other Lines	Light Gray

15120.3.3 PIPE RESTRAINTS

The CONTRACTOR shall provide mechanical pipe restraints in accordance with the DRAWINGS and these SPECIFICATIONS. All restraints shall be in place before any hydrostatic testing is performed on the system. Pipe shall be properly blocked or restrained at all fittings wherever the pipeline makes a sudden change in direction of 11.25 degrees or more, wherever it changes sizes, or wherever it ends. Restraints shall be installed in accordance with the details shown on the DRAWINGS.

The CONTRACTOR shall allow the ENGINEER to visually inspect every mechanical restraint before it is buried.

15120.3.4 FLUSHING AND CLEANING - Prior to proceeding with pressure testing and disinfection of completed lines, the CONTRACTOR shall fill the test section with clean potable water and flush the lines. Certain contaminants, especially in caked deposits, resist flushing at any velocity. If, in the opinion of the ENGINEER, contaminants have entered the line during construction that will not be removed by flushing, the interior of the pipe shall be pigged or swabbed, as necessary, to remove the debris prior to proceeding with flushing.

15120.3.5 TESTING

15120.3.5.1 The CONTRACTOR shall perform all testing, and shall furnish all materials, equipment, and labor necessary to complete this WORK as required. Any WORK that fails to meet the acceptance criteria of prescribed testing, shall be repaired and/or replaced at no additional cost to the OWNER and then re-tested. This sequence shall be repeated until the WORK meets the

acceptance criteria.

15120.3.5.2 PRESSURE TESTING

15120.3.5.2.1 All pipelines for carrying potable, non-potable, and water-borne products shall be pressure tested for leakage when they are completed, unless directed otherwise in these SPECIFICATIONS or in writing by the ENGINEER.

15120.3.5.2.2 WARNING - The hydrostatic test procedures described herein are not applicable to air pressure testing.

15120.3.5.2.3 Prior to pressurization all required flushing shall have been completed. Pipeline sections to be tested shall be isolated. The test section shall be filled with clean potable water, and all air shall be removed from the line. Pressure on the test section shall then be brought to full test pressure and maintained at that level for a period of not less than 4 hours. Pipelines shall be tested at 50 PSI over normal static pressures or to the manufacturer's class rating, which ever is lower.

15120.3.5.2.4 No leakage will be allowed in the plant piping system. Should any leaks be discovered, the CONTRACTOR shall locate and repair the leak, and shall then be re-tested by the CONTRACTOR until compliance is achieved.

15120.3.6 DISINFECTION

15120.3.6.1 All pipelines to be used for culinary water shall be disinfected in accordance with the requirements of the latest revision of ANSI/AWWA C-651, the State of Wyoming Rules/Regulations and local requirements.

15120.3.6.2 The CONTRACTOR may use any method prescribed by the referenced standards; however, the "slug method" is preferred. This method basically consists of filling the line with potable water and then injecting a "slug" of concentrated chlorine solution (100 mg/L) at the upstream end of the line. The "slug" is then moved through the line by slowly draining the low end. When properly conducted, this procedure provides contact to the interior pipe surfaces with a heavily concentrated dose of chlorine to achieve disinfection.

15120.3.6.3 After disinfection, the lines are flushed until residual chlorine is reduced to the levels found in the rest of the OWNERS system, or until they reach levels safe for consumption. Samples for bacteriological testing can then be taken. The CONTRACTOR shall safely and legally dispose of contaminated water used for disinfection after consultation with the local authorities. Under no circumstances shall heavily chlorinated water be allowed to mix with "live" waters, meaning waters in lakes, rivers, streams or wetlands.

15120.3.7 TESTING DOCUMENTATION

The CONTRACTOR shall maintain a record of all testing performed, and the test results obtained for the lines installed under this CONTRACT. Minimum information contained on the record shall include the following:

1. All Documents:

    A. Date of issuance of the record
    B. Name of CONTRACT
    C. CONTRACTOR's name and address

2. Disinfection Report:

   A. Name and address of treatment supervisor
   B. Disinfection method used
   C. Location and boundary description of section to be disinfected
   D. Time and date of disinfectant introduction
   E. Time and date of disinfectant release
   F. Initial disinfectant residual (ppm) for each outlet tested
   G. Time and date of flushing after disinfection
   H. Signature of treatment supervisor (signifies completion of disinfection activities)

3. Bacteriological Report:

   A. Date issued
   B. Project name and location
   C. Laboratory's name, certification number, address and phone number
   D. Test location
   E. Time and date of sample collection
   F. Name of person collecting sample
   G. Time and date of laboratory test start
   H. Coliform bacteria test results for each sample
   I. Certification that water conforms (or fails to conform) to bacterial standards of State of Utah public drinking water regulations
   J. Bacteriologist's signature

4. Pressure Test Report:

   A. Type of test
   B. Location of test
   C. Sizes, types, and lengths of pipe in test section, and test boundary description
   D. Date and Time test started
   E. Date and Time test completed
   F. Test pressure
   G. Amount of leakage
   H. Test result
   I. Printed Name/Signature and Date of Test Supervisor (CONTRACTOR's representative)
   J. Printed Name/Signature of Inspector (ENGINEER’s representative) witnessing and approving the test

15120.4 METHOD OF MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

15120.5 BASIS OF PAYMENT

Not used.

15125.1 DESCRIPTION

15125.1.1 The Contractor shall furnish and install a piping system designated for fuel gases, such as natural gas, manufactured gas, undiluted liquefied petroleum gases, liquefied petroleum gas-air mixtures, or mixtures of any of these gases. Pipe and fittings shall be of the type, class, and size, shown on the Drawings and in these Specifications.

15125.1.2 Piping layout on the Drawings shall be considered diagrammatic for all piping not shown with detailed dimensions. Pipe size and location are provided, but the Drawings are not intended to show every offset, fitting, or structural difficulty that will be encountered during project construction.

15125.1.3 At no additional cost to the Owner, and with written permission from the Engineer, piping alignment may be varied from that shown on the Drawings, to avoid structural or mechanical difficulties, or to avoid the work of other trades. The Contractor shall provide all materials and labor required to complete all work in accordance with the best practice of the trade, and to the satisfaction of the Engineer.

15125.2 SUBMITTALS

The Contractor shall submit for review complete information, showing all pipe, materials, fittings, gaskets, couplings, coatings, supports, pipe supports, and configuration prior to the delivery of any components to the project. All information shall be provided in accordance with Section 01300 and written evidence of compliance from the manufacturer shall be provided with each delivery of material.

As construction proceeds, the Contractor shall submit test documentation in accordance with this section of these Specifications.

15125.3 MATERIALS

15125.3.1 PIPE AND FITTINGS

Piping shall be black-iron pipe (bare) schedule 40 or 80 as shown on the Drawings, (unless otherwise specified) and shall meet requirements of ASTM A-53, ASTM A-106, and API-5L grade B. Pipe joints shall be threaded, unless otherwise indicated on the Drawings. Galvanized iron, copper, brass, aluminum alloy or polyethylene pipe, (or tubing), is not acceptable.

Fittings shall be forged steel, conforming to ASTM A105, 2000 psi, threaded.

Threads for pipe and fitting shall comply with the American Standard for Pipe Threads B2.1 or ANSI(ASME) B1.20.1. Pipe with threads which are stripped, chipped, corroded, or otherwise damaged, shall not be used.

Pipe and fittings shall be clear and free from cutting burrs and defects in structure or threading. Defects in pipe shall not be repaired. When defective pipe or fittings are located in a system, the defective material shall be replaced.

15125.3.2 PIPE COATING

All buried piping, or piping otherwise in contact with a material exerting a corrosive action, shall be coated with a corrosion resisting material. Pipe coating systems shall be X-TRU Coat, TGF-3, YG-3, Scotch Coat, Fusion Bond Epoxy, or approved equal.

15125.3.4 FASTENERS

Unless otherwise required in these specifications or on the Drawings, all bolting materials for all pipe, fittings, valves, and components shall be Type 316 stainless steel unless otherwise required in the Contract Documents.

15125.4 CONSTRUCTION REQUIREMENTS

15125.4.1 HANDLING AND REJECTION OF MATERIALS

Care shall be taken during handling of pipe, to avoid impact, which might cause damage. Dropping pipe during unloading will not be permitted. If any cause for rejection is discovered in a pipe, it shall be removed and replaced by the Contractor, at no additional cost to the Owner. Any pipe found to be unfit or rejected shall be removed from the job site.

15125.4.2 INSTALLATION

No person, unless in the employ of or having permission from the serving gas supplier, shall open or make connections with a gas main. No person, unless in the employ of or having permission from the serving gas supplier, shall repair, alter, open or make connections to the service gas piping, or do any work on the parts of the gas supply system up to the meter set assembly.

In case any work done by a gas fitter or plumber discloses the need for repairs or alterations on any part of the gas supply system, the serving gas supplier shall be notified promptly of this fact.

If gas is leaking from any part of the gas supply system, a gas fitter or plumber no in the employ of the serving gas supplier may make necessary repairs and shall notify the serving gas supplier.

Pipe and fittings shall be assembled so there will be no distortion or springing of the pipelines. Flanges, unions, couplings and other connections shall come together at the proper orientation. The fit shall not be made by springing piping, nor shall orientation or alignment be corrected by taking up on any flange bolts. Threaded joints, flange bolts, union halves, etc., shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to fit.

Gas pipe shall not be bent. Fittings shall be used when making turns in gas pipe.

No exposed piping shall be installed until all equipment to which the pipe is to be attached has been installed and it can be determined where piping and fittings shall be located to make a neat, efficient arrangement. Pipe shall be installed in straight runs parallel to the axis of the structures. Pipe runs shall be horizontal and vertical. Piping shall be installed with a sufficient number of unions or couplings, in addition to those shown on the Drawings, to allow for convenient inspection and maintenance.

Joint compound (pipe dope) shall be applied sparingly and only to the male threads of pipe joints. Such compounds shall be resistant to the action of liquefied petroleum gases.

Exposed pipe work shall be suspended or supported, to prevent sagging or over stressing of the pipe and connections. Gas piping shall not be supported by other piping. Gas piping shall not be run in or through an air duct, crawl space, chute, chimney or gas vent, ventilating duct, or elevator shaft.

Each outlet, including a valve or cock outlet , shall be securely closed gastight with a threaded plug or cap immediately after installation and shall be left closed until the equipment is connected

thereto. Likewise, when the equipment is disconnected from an outlet and the outlet is not to be used immediately, it shall be securely closed gastight.

The building structure shall not be weakened by the installation of the gas piping. Before any beams or joists are notched, special permission shall be obtained from the Engineer in writing.

No gas pipe smaller than ½" iron pipe size shall be used in any concealed location.

Underground gas piping shall buried at a sufficient depth, (18" minimum), or covered in a manner so as to protect the piping from physical damage.

15125.4.3 PRESSURE TESTING

The Contractor shall perform all testing, and shall furnish all materials, equipment, and labor necessary to complete this work as required. Any work that fails to meet the acceptance criteria as prescribed, shall be repaired and/or replaced at no additional cost to the Owner and then re-tested. This sequence shall be repeated until the work meets the acceptance criteria.

Before any system of gas piping is put into service, it shall be pressure tested to assure that it is gas tight. Where any part of the system is to be enclosed or concealed, testing should proceed the work of closing in. The test pressure used shall be capable of disclosing all leaks in the section being tested.

The test fluid shall be air, water or inert gas (e.g., nitrogen, carbon dioxide) provided means are used for removing all test fluid. Oxygen shall never be used.

Equipment shall not be included in the test and under no circumstances shall a valve in a line be used as a bulkhead between a section of the piping system being tested and adjacent section not being tested.

The test pressure used shall be no less than 1 ½ times the proposed working pressure, but not less than 3 psi. Test duration shall be long enough to determine if there are any leaks but not less than one-half hour for each 100 cubic feet of pipe volume, but not less than 10 minutes.

The piping system shall withstand the test pressure, without showing any evidence of leakage or other defects. While subject to test pressures the piping system shall be visually examined for signs of leakage or other defects. If air or inert gas is used, all exposed joints shall be checked by means of a soap bubble test. If leakage or other defects appear, the affected portion of the piping system shall be repaired or replaced and retested afterwards.

The Contractor shall maintain a record of all testing performed. Records shall be made for each piping section tested. A certification shall be made that all piping has been pressure tested by the standard.

All testing of piping systems shall be done with due regard for the safety of employees and the public during the test

15125.4.3.4 PURGING AND COMISSIONING

Suitable precautions shall be taken whenever a piping system, which is full of air, is cleared with a combustible gas. A slug of inert gas should be introduced to prevent the formation of an explosive mixture at the interface between gas and air, or the gas and air mixture shall be cleared to a safe location outside the building.

Before gas is turned into a system of new gas piping, or back into an existing system after being shut off, the entire system shall be to determine that there are no open fittings or ends and that all valves at outlets and equipment are closed.

After the piping system has been tested and determined to be free of leakage, the gas may be turned on and the service established.

15125.5 METHOD OF MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

Where items installed under this section are listed separately in the Bid Schedule, natural gas piping shall be measured by the linear foot of furnished, installed, and excepted pipe. Included in the linear measurement shall be all fittings, valves, and pipe, unless shown otherwise in the Contract Documents.

15125.6 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

When a separate bid item is provided in the Bid Schedule, complete compensation for this accepted work shall be included in the contract at the unit price listed on the Bid Schedule.

PAY ITEM	UNIT
Black Iron Pipe (Schedule) (Size)	Lineal Foot

SPECIAL PROVISION

WATERLINE VALVES AND HYDRANTS — SECTION SP15230

15230.1 DESCRIPTION

This section covers furnishing and installing valves and fire hydrants in water transmission and distribution lines, together with fittings, thrust blocking, and boxes and enclosures related to the operating equipment.

15230.1.1 RELATED WORK

Section 02222 - Waterline Pipe Installation
Section 15110 - Pipe and Piping Systems
Section 15232 - Water System Control Valves

15230.1.2 SUBMITTALS

All information shall be provided in accordance with Section 01300. Written evidence of compliance from the manufacturer shall accompany each delivery of material.

15230.1.2.1 VALVES 12 INCHES AND SMALLER, AND HYDRANTS - For valve sizes 12-inches and smaller, and fire hydrants, the Contractor shall furnish the manufacturer's standard data and catalogues for review and approval.

15230.1.2.2 VALVES LARGER THAN 12 INCHES - For all valves sized larger than 12-inches, the Contractor shall furnish shop drawings and technical data prepared by the manufacturer for review and approval.

15230.1.2.3 CONTENT - Submittals shall include complete details, dimensions, weights, diameter of stems, alloy for all valve parts and any information that may be required to assemble, install, operate and maintain the valve.

15230.1.2.4 BUTTERFLY VALVES - Certification of performance together with leakage and hydrostatic tests as described in Section 13 of ASTM/AWWA C-504 shall be furnished to the Engineer upon the Engineer's request.

15230.1.2.5 BALL VALVES - Certification of performance together with leakage and hydrostatic tests as described in Section 5 of ASTM/AWWA C-507, shall be furnished top the Engineer upon the Engineer's request.

15230.1.3 DEFINITIONS

Not used.

15230.2 MATERIALS

15230.2.1 GATE VALVES

The City has a strong preference for Kennedy brand gate valves for inventory, maintenance and rebuild reasons. Kennedy brand gate valves shall be used for this project.

15230.2.1.1 COMPLIANCE - All gate valves shall conform to AWWA C-500 or C-509 with the following characteristics:

15230.2.1.2 3-INCH AND SMALLER VALVES - Valves 3-inches and smaller shall be as follows:

- Valves shall be as manufactured by Ford, Hayes, Mueller, Red & White, or an approved equal.

- Valves shall be standard, double-disc, non-rising stem valves with wheel handles.
- Valve bodies shall be all bronze or brass.
- Valves shall be threaded, unless shown otherwise on the Drawings or required in these Specifications.

15230.2.1.3 GATE VALVES 4-INCH THROUGH 14-INCH – Gate valves 4-inches through 14-inches in size shall be as follows:

- Valves shall have a ductile iron body.
- Valves shall have a solid cast iron, rubber coated, wedge gate and a resilient seat.
- Gate shall be designed to work equally well with pressure on either side of it.
- Valves shall be of the non-rising stem type and shall be left hand opening (counter-clockwise) with a 2-inch square operating nut.
- All interior ferrous surfaces exposed to fluid flow shall have an NSF approved, fusion bonded, epoxy coating. Epoxy coatings shall be factory applied by an electrostatic or thermosetting process.

15230.2.1.4 GATE VALVES 16-INCHES AND LARGER - Gate valves 16-inches and larger shall be as follows:

- Valves shall be double-disc gate valves with flanged ends.
- Valves shall be manufactured in accordance with AWWA C-500. Bolts, nuts, studs, etc., used with the gear case also shall conform to the requirements for Bonnet Bolting in AWWA C-500.
- Valves shall have bevel gears and shall be actuated by 2-inch square operating nuts.
- The gears and stuffing box shall be enclosed in a watertight cast or ductile iron case for operation in buried location.
- The case shall be filled with grease at the factory.
- Valves shall be designed to operate in a horizontal orientation.
- Valves shall be equipped with bronze tracks, rollers and scrapers.
- By-pass valves shall be furnished with each valve mounted in position A as indicated in AWWA C-500.

15230.2.1.5 VALVES ON WATER MAINS - Valves on water mains shall have the following features:

- In-line valves shall have push-on or mechanical joints conforming to AWWA C-111.
- Valves attached to side outlets shall be flanged.
- By-pass valves shall be flanged.
- Valves in blow-off lines shall be flanged.

- Valves in fire hydrant lines shall have push-on or mechanical joints.
- Valves in air release and vacuum relief lines shall be flanged or threaded.
- Valves 12-inches and smaller shall be equipped with O-ring packing.

15230.2.2 BUTTERFLY VALVES

15230.2.2.1 MANUFACTURER - Butterfly valves shall be Dresser Industries "450", Allis-Chalmers "Streamseal", Henry Pratt "Groundhog", Mueller Lineseal III, or an approved equal.

15230.2.2.2 COMPLIANCE - Butterfly valves shall conform to AWWA C-504.

15230.2.2.3 CLASS - Valves shall be Class 150 seated, tight closing valves, furnished with mechanical or flanged joints

15230.2.2.4 SEATS - Rubber valve seats shall be replaceable without disassembling the valve and shall not be interrupted by the shafting. Rubber seats may be retained on the disc edge by stainless steel clamping in lieu of bonding to the valve body.

15230.2.2.5 SHAFT PACKING - Shaft packing shall be of the self-adjusting permanent type.

15230.2.2.6 OPERATION - Underground opening and closing shall be accomplished with permanently lubricated screw-type operators, totally enclosed and of watertight construction. Overload protection shall be incorporated into the operator allowing the application of 450 foot-pounds input torque at full-open and full-closed positions without damage to the operator or valve. A 2-inch square wrench nut and valve box shall be provided for operating the valve. Valves shall open counter clockwise unless indicated otherwise in the Special Provisions.

15230.2.3 BALL VALVES

15230.2.3.1 MANUFACTURER - Valves shall be produced by a manufacturer having at least five years experience in the manufacture of water works and valves.

15230.2.3.2 VALVES 4-INCHES AND LARGER - Ball valves, 4-inches and larger, shall be ductile iron or cast-steel body, double seated valves meeting the requirements of ANSI/AWWA C-507.

15230.2.3.3 SMALLER VALVES - Smaller valves shall be stainless steel, bronze, or iron bodied valves of the size, type and class shown on the Drawings.

15230.2.4 CHECK VALVES

15230.2.4.1 COMPLIANCE - Check valves shall be manufactured in accordance with ANSI/AWWA C-508.

15230.2.4.2 DESIGN - Check valves shall be of a clear waterway, swing-check type. They shall be designed to be mounted horizontally. They shall be fitted with flanged ends for easy servicing. They shall have an iron body and be bronze mounted.

15230.2.4.3 SEATING - Valves shall be provided with a metal to resilient material seating.

15230.2.5 HOSE BIBS

Hose bibs shall be 3/4-inch bronze or brass body, Watts Model SC-1, Red & White Model RW 301 or approved equal. All hose bibs shall have a tee handle.

15230.2.6 SAMPLE FAUCET

Sample faucet shall be a ½-inch chromed or brass body hose bib without hose connection threads.

15230.2.7 FIRE HYDRANTS

The City requires Kennedy brand K81D model hydrants for this project for maintenance, rebuild and parts inventory purposes.

15230.2.7.1 COMPLIANCE - Fire hydrants shall conform to standard for dry barrel fire hydrants, AWWA C-502 and modifications herein specified.

15230.2.7.2 DESIGN - Hydrants shall be designed as follows:

- Hydrants shall be of the "compression" or "toggle joint" type with safety flange and safety stem coupling above the ground line so that they can be repaired without shutting off the water.
- Hydrants shall be of the dry top design with two or more "O" rings sealing the water from the operating mechanism.
- Hydrants shall be furnished with 5-inch minimum valve openings, one 4 1/2-inch NST pumper connection and two 2 1/2-inch hose connections.
- Hose nozzle threads, pump nozzle threads, operating nut and opening direction shall match existing hydrants in the system.
- Hydrant lengths shall be designed for the cover depth shown on the drawings plus the diameter of the main line pipe.

15230.2.7.3 PAINTING - The portion of the hydrant above the ground line shall be painted in accordance with the Owner's standards.

15230.2.8 OPERATING WRENCHES

Unless notified otherwise by the Engineer, the Contractor shall furnish two, T-handle, operating wrenches for each project incorporating valves with 2-inch, square-head, operating nuts.

15230.2.9 VALVE BOXES

Valve boxes shall be cast iron, two piece, and adjustable valve boxes. Valve boxes shall be of the slip joint type and be of sufficient length for the pipe burial depth required. The cast iron cover of the valve box shall have the word "water" stamped thereon.

15230.2.10 CONCRETE ENCLOSURES

Concrete enclosures for valves shall be precast and of the type, size and configuration shown on the Drawings and shall be fabricated in accordance with the requirements for precast concrete construction provided in Section 03500.

15230.3 CONSTRUCTION REQUIREMENTS

15230.3.1 SETTING VALVES AND VALVE BOXES

All valves shall be set and jointed to the pipe in the manner described for pipe laying and jointing in Section 02222 of these Specifications. Valves shall be oriented with the operating nut vertical. Valve boxes shall be centered and plumb over the operating nut and shall be set so that no shock or stress will be transmitted to the valve. Tops of the valve boxes shall be set flush with the ground surface, concrete collars, or street surfacing, unless otherwise shown on the Drawings.

15230.3.2 VALVE RESTRAINT

Restraint shall be installed on all valves connected with slip-on, gasketed, or O-ring joints (i.e., bell & spigot, mechanical, etc.) in accordance with these Specifications and as shown on the Drawings.

15230.3.3 CONNECTING TO EXISTING MAINS

15230.3.3.1 CONNECTION TO EXISTING WORK - All connections to existing water mains shall be made by the Contractor, unless otherwise provided in these Specifications. The Contractor shall provide labor and materials, including special fittings and restraint devices, required to make the required connections between existing lines and new lines.

15230.3.3.2 INTERRUPTION OF SERVICES - Where the connection of new work to old requires interruption of service, the Owner, Engineer and Contractor shall mutually agree upon a date for such connection which will allow ample time to assemble labor and materials and to notify all customers in accordance with Section 01510.

15230.3.4 FIRE HYDRANT INSTALLATION

15230.3.4.1 SETTING - All hydrants shall stand plumb use hand level with the pumper nozzle facing the street. The hydrant shall be set with the ground line at the location indicated by the hydrant manufacturer.

15230.3.4.2 DRAINAGE - Drainage shall be provided at the base of the hydrant by placing clean gravel under and around the base of the hydrant as shown on the Drawings.

15230.3.4.3 RESTRAINT - All hydrants shall be restrained by setting thrust blocks or mechanical restraint assemblies in accordance with the Drawings.

15230.3.4.4 AUXILIARY GATE VALVES - All fire hydrant assemblies shall include auxiliary gate valves positioned as shown on the Drawings.

15230.3.5 THRUST BLOCKS

Thrust blocks shall be formed to prevent coverage of the pipe joints in accordance with the details shown on the Drawings and as described in Section 03100 and 03050. All thrust blocks shall be set against undisturbed earth.

15230.4 METHOD OF MEASUREMENT

15230.4.1 VALVES

Excavation, foundation preparation, restraint devices, valve boxes, backfill, and other miscellaneous devices, materials, or equipment required for installation shall be considered part of and included in the measurement of all valves and valve assemblies.

15230.4.1.1 NUMERICAL COUNT - When valves are installed as separate items or assemblies, the measurement shall be determined by counting the number of each size and type (including any associated valve box and concrete valve box collar) of valve installed and accepted.

15230.4.1.2 LUMP SUM - When valves are located in an enclosure, measurement shall be made as lump sum for the enclosure assembly and shall include the valve, any supplemental valves and fittings in the enclosure, and the enclosure.

15230.4.2 HYDRANTS

Measurement of hydrants shall be made by counting the number of hydrants set and accepted. For each hydrant, this measurement shall include the tee, shut-off gate valve, excavation and backfill, drain gravel, valve box and concrete collar, restraint, hydrant, and 5-feet of pipeline extending from the tee on the main line to the hydrant.

15230.4.3 NO SEPARATE MEASUREMENT

No separate measurement will be made for thrust blocks or other restraint provided with valves and fittings. Neither will separate measurement be approved for sample faucets, hose bibbs, and 3-inch and smaller valves used for appurtenances or associated with the pump station and air/vacs. Measurement for these items will be included with the quantity of the assembly whereon they are installed.

15230.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price.

PAY ITEM	UNIT
(Size) Gate Valve	Each
(Size) Ball Valve	Each
(Size) Ball Valve	Each
(Size) Butterfly Valve	Each
(Size) Check Valve	Each
Fire Hydrant Assembly	Each

SPECIAL PROVISION

WATER SYSTEM CONTROL VALVES — SECTION SP15232

15232.1 DESCRIPTION

This section covers furnishing and installing water system control valves, including: pressure release, pressure sustaining, pressure reducing, water level control, air relief, vacuum relief, deep well pump control, back flow prevention and surge control with their enclosures and miscellaneous support equipment.

15232.1.1 RELATED WORK

Section 02222 - Waterline Pipe Installation
Section 03050 - Portland Cement Concrete
Section 03100 - Concrete Forming, Finishing and Curing
Section 03200 - Concrete Reinforcement
Section 15110 - Pipe and Piping Systems
Section 15230 - Waterline Valves and Hydrants

15232.1.2 SUBMITTALS

15232.1.2.1 CERTIFICATION OF COMPLIANCE - Certification of compliance to the standards and Specifications contained herein shall be obtained from the manufacturer and provided by the Contractor at the time of delivery of these materials to the project site.

15232.1.2.2 DESCRIPTIVE LITERATURE - Descriptive literature which identifies the manufacturer, model numbers, materials of which the control valves are fabricated, and their capacities shall be provided by the Contractor in accordance with Section 01300 of these Contract Documents.

15232.1.2.3 OPERATION AND MAINTENANCE INSTRUCTIONS - Manufacturer's installation, operation and maintenance literature for each control valve shall be furnished to the Owner prior to the time of final acceptance for payment.

15232.1.3 DEFINITIONS

Not used.

15232.2 MATERIALS

15232.2.1 GENERAL

All control valves furnished and installed under this contract shall be of the model, size, and type shown on the Drawings or required in these Specifications. They shall have been produced by the same manufacturer and shall be provided by a supplier located in the state in which the installation is to be made. They shall be furnished with a manufacturer applied, NSF approved, fusion bonded, epoxy coating. Seats shall be designed so that they are easily maintained and without edges that induce cutting or wear at low flows. Unless otherwise required to meet specific service conditions, all cast iron or steel valves shall be 150 lb. Class.

15232.2.2 ALTITUDE CONTROL VALVES

Altitude control valves shall be as manufactured by CLA-VAL Company, or approved equal. Valves shall be of ductile iron flanged, spring loaded, 3-way, diaphragm actuated, globe pattern valves. Valve control shall be provided by a pressure difference sensor (and when called for on the Drawings or in these Specifications, fitted with a direct acting solenoid control) with appropriately sized piping and supports. Valves shall have a valve position indicator, cocks to isolate the pilot system and

losing speed control. Four-inch and smaller valves shall be fitted with flow clean strainer while larger valves shall be provided with a "Y"-pattern strainer in the pilot control system.

15232.2.3 PRESSURE RELIEF/PRESSURE SUSTAINING VALVES

Shall be ductile iron, modulating, hydraulic operated, pilot controlled, flanged valves with globe pattern. All pressure sustaining valves shall be designed to maintain constant upstream pressure at the set point indicated on the Drawings or in the Special Provisions. Pressure sustaining valves shall be provided with a position indicator operated by a pressure difference sensor and shall have appropriately sized piping and supports. The pilot system shall be capable of being isolated with shut-off cocks, be fitted with a strainer, and shall be able to control closure to prevent surges.

15232.2.4 COMBINATION BACK PRESSURE/SOLENOID SHUTOFF VALVE

Shall be ductile iron, flanged, globe pattern, modulating hydraulic operated, pilot controlled, with solenoid activated shut-off. The valve shall open sufficiently to maintain a pre-set inlet (back) pressure. When the inlet pressure is less than the control setting, the pilot system shall close the valve tight. The pilot system shall be capable of being isolated with shut-off cocks, be fitted with a strainer and shall be able to control closure to prevent surges.

15232.2.5 PRESSURE REDUCING VALVES

Shall be modulating pressure reducing with globe pattern. Valves shall be provided with pilot control which operates such that positive and gradual closure can occur to prevent any surge or line shock. Pressure reducing valves shall be equipped with a valve position indicator, cocks to isolate the pilot system, speed for control of closure and a strainer on the pilot system inlet.

15232.2.6 BACK-FLOW PREVENTION VALVES

Shall be an assembly of double independently acting, spring-loaded toggle lever check valves with two shut-off valves which meet the requirements of ANSI/AWWA C-506. Valve body and cover shall be of bronze. Valves shall be fitted with stainless steel springs and with molded synthetic rubber clapper, poppet and facing rings.

15232.2.7 AIR/VACUUM RELIEF VALVES

Shall be simple lever type, kinetic combination air valves, with cast iron body and stainless steel floats. Vents for air/vacuum relief valves shall be threaded GI pipe and open ends shall be protected with No. 14 stainless steel, bronze or aluminum screen. Threads exposed to earth shall be wrapped in wax tape extending 1-inch onto adjacent pipe and fitting.

15232.2.8 DEEP WELL SOLENOID PUMP CONTROL VALVE

Shall be globe pattern, hydraulically operated diaphragm valve controlled by a solenoid pilot valve. The pilot system shall have separate adjustable flow control valves, a "Y" strainer, and shall be fitted with cocks to enable isolation during servicing. The valve stem shall have a limit switch to serve as an electrical interlock between the valve and pump motor.

15232.2.9 ENCLOSURES

Enclosures for control valves shall be concrete, furnished and installed in accordance with the Drawings and the requirements of Sections 03100, 03200, and 03050 of these Specifications.

15232.2.10 MISCELLANEOUS PIPE, FITTINGS, VALVES AND EQUIPMENT

Miscellaneous pipe, fittings, valves and equipment needed to assemble and support operation of the control valves shall be as shown on the Drawings and in conformance with Sections 02222, 15110, and 15230 of these Specifications.

15232.3 CONSTRUCTION REQUIREMENTS

Prior to installing control valves, the Contractor shall flush, blowout, or otherwise clean all dirt and debris from connecting lines. Control valves shall be installed with appropriate supporting piping and equipment in accordance with manufacturer's recommendations. Control valves shall be fitted with flanged connections or installed in a manner which will allow easy removal in the enclosure or area wherein the valves are installed. As soon as control valves are pressurized (placed in service), the Contractor shall check and adjust, if necessary, all valve assemblies to assure they are adjusted correctly and functioning as designed.

15232.4 METHOD OF MEASUREMENT

15232.4.1 NO MEASUREMENT

Measurement will not be made for control valves that are installed as part of a structure or assembly identified as a separate line item in the Bid Schedule. In such cases, valves and their installation will be included in the lump sum quantity represented for that structure. In such cases, measurement will include all valves, couplings, enclosures, manhole covers, bollards, excavating and footings required and other necessary equipment and materials required to complete the assembly as shown on the Drawings.

15232.4.2 SEPARATE MEASUREMENT

When valves are identified as individual line items on the Bid Schedule, quantities shall be measured by counting the numbers of each type of valve in place and accepted.

15232.5 BASIS OF PAYMENT

The accepted quantity will be paid for at the contract unit price:

PAY ITEM	UNIT
Altitude Valve (size, type)	Each
Float Valve (size, type)	Each
Pressure Relief Valve (size, type)	Each
Pressure Sustaining Valve (size, type)	Each
Pressure Reducing Valve (size, type)	Each
Pressure Reducing Valve (size, type)	Each
Back Pressure Valve (size, type)	Each
Backflow Prevention Valve (size, type)	Each
Air Release Valve (size, type)	Each
Vacuum Relief Valve (size, type)	Each
Air/Vacuum Relief Valve (size, type)	Each
Combination Air/Vacuum Valve (size, type)	Each
Sewage Air Relief Valve (size, type)	Each
(Type)Valve Assembly	Each

15234.1 DESCRIPTION

Includes furnishing and installing materials which include excavation, water main tapping, stops, valves, service lines, meters, settings, boxes and other accessories required for installing water services to system users.

15234.1.1 RELATED WORK

Section 02200 - Trench Excavation and Backfill
Section 02222 - Waterline Pipe Installation
Section 15110 - Pipe and Piping Systems

15234.1.2 SUBMITTALS

15234.1.2.1 DESCRIPTIVE LITERATURE - Descriptive literature which identifies the manufacturer, model, size, material and parts lists from which the piping, fittings, valves and meters are manufactured, including installation instructions, shall be provided to the Engineer in accordance with Section 01300.

15234.1.2.2 CERTIFICATION OF COMPLIANCE - Written certification of compliance from the respective manufacturer shall be provided with each delivery of metal fittings, valves and meters.

15234.1.3 DEFINITIONS

Mains - Water distribution pipes, located in streets or rights-of-ways, to which water service connections are made for users of the system.

Tap - The actual connection made to water mains which includes drilling an opening into the main, threading, installing a tapping saddle when appropriate, and inserting (screwing) a valve into the opening.

Saddle - A fitting placed on a pipe to reinforce the pipe wall through which the tapping hole is drilled.

Key - Can mean either: the center piece of a corporation or curb valve which is turned to control flow through the valve; or, the "T-shaped" tool used by operators to reach and turn the key or closing piece of a valve.

Setter (also referred to as "yoke") - Is the prefabricated assembly of pipes and valves installed in a meter box and connected into the service line in which the water meter is mounted (or "set").

15234.2 MATERIALS

15234.2.1 SADDLES

Saddles shall be copper alloy body with copper alloy or stainless steel straps designed and sized specifically for tapping PVC water mains. Threading shall be tapered and the saddle shall conform to ANSI/AWWA C-800. Straps shall provide full support around the circumference of the pipe and have a bearing area of sufficient width along the pipe axis so that the pipe will not be distorted when tightened.

15234.2.2 CORPORATION STOPS

Corporation stops shall be copper alloy body ball-type or balanced pressure, o-ring sealed plug type valves with tapered threads and in conformance with the requirements of ANSI/AWWA C-800.

15234.2.3 CURB VALVES

Curb valves shall be copper alloy body ball-type valves; or balanced pressure, o-ring sealed, plug type valves. Curb valves shall be furnished with cast iron curb boxes and one-piece lids fitted with copper alloy pentagon plug. The curb box shall be sized to properly fit the valve and adjust to the depth to which the valve is set.

15234.2.4 SERVICE LATERAL PIPE

Service lateral pipe shall be as called for on the Drawings and in accordance with the following:

15234.2.4.1 COPPER SERVICE PIPE - Copper service pipe shall be Type K soft, conforming to Federal specification WW-T-799 or ASTM B88-62.

15234.2.4.2 POLYETHYLENE PIPE - Polyethylene service pipe shall conform to the requirements of AWWA C-901, "Polyethylene (PE) Pressure Pipe, Tubing and Fittings, 2-inch through 3-inch for water." PE Pipe shall be pressure tubing conforming to Table 6 of said Specification. Tubing shall be Class 160 with a DR of 9.0 or Class 200 with a DR of 7.3. If not specified, DR 7.3 shall be used.

15234.2.4.3 Ends of polyethylene tubing inserted in compression connections should be fitted with insert reinforcement.

15234.2.5 METER SETTER (YOKE)

Meter setter shall be fit with copper tubing (when required), copper alloy, and copper alloy fittings. Setters shall be furnished with copper alloy body, angle, or straight, ball-type inlet valves with fittings appropriately sized to fit the meter. When required, a cast iron yoke ban shall be furnished to provide the setting.

15234.2.6 CHECK VALVE

Unless indicated otherwise on the Drawings, a check valve shall be provided with each meter setting. Check valves shall be copper alloy bodied, dual valves which meet the requirements of the State and local health authorities and conform to ASTM/AWWA C-510.

15234.2.7 WATER METERS

Water meters shall be cold-water displacement type meters, which complies with ANSI/AWWA C-700. The main case and bottom plate shall be of bronze and the meter shall be sized and equipped as shown on the Drawings. The meters shall be Model SR II by SENSUS Technologies, PMM Multi-Jet Series by Precision Meters, or an approved equal.

15234.2.8 METER BOX

Meter boxes shall be fabricated from rigid PVC or ABS plastic pipe. They shall be white in color. They shall have a minimum diameter of 18-inches, be sized to fit over the meter assembly while allowing reasonable interior access, and shall make an appropriate fit with the meter box ring and cover.

15234.2.9 METER BOX RING AND COVER

The meter box ring and cover shall be cast iron with a minimum diameter of 18-inches but shall be appropriately sized to fit larger meter boxes where required. The words "WATER METER" shall be cast into the cover. The cover shall be a locking type with a pentagonal head, corrosion resistant, screw down, locking device.

15234.2.10 METER BOX DRAINAGE

Meter box drainage shall be provided by placing 3-cubic yards of drain gravel at the base of new meter box drain.

15234.3 CONSTRUCTION REQUIREMENTS

15234.3.1 TRENCHING AND BACKFILL

Trenching and backfill for installation of service connections shall be completed in accordance with Section 02200. Service lines shall have a minimum of 3.5-feet of cover.

15234.3.2 INSTALLATION OF CONNECTIONS

Installation of water service connection components shall be as shown on the Drawings. All connections to PVC pipe shall be made by using a saddle rather than a direct tap. Service lines shall be slightly snaked in the trench near the connection to the water main to allow for some movement to avoid a rigid connection.

15234.3.3 REPLACEMENT OF EXISTING FACILITIES

When replacement of specified components of service connections is required, the Contractor shall: protect existing equipment, provide appropriate connecting fittings to accommodate the new component, use care in removal and salvaging of the existing component, and deliver the existing components to the Owner's maintenance shop or headquarters.

15234.4 METHOD OF MEASUREMENT

15234.4.1 CONNECTIONS

Measurement for service connections shall be made by counting the number of "each" size of connection (consisting of furnishing and installing: (1) service saddle on the water main; (2) drilling and tapping; (3) corporation stop; and (4) the necessary excavation and backfilling) installed and accepted.

15234.4.2 SERVICE LATERALS

Service laterals shall be measured using an accurate measuring device to determine the number of linear feet of each size of service lateral pipe installed between the corporation stop and the meter setter. This measurement shall include furnishing and installing the pipe and appropriate connecting fittings and any necessary trench excavation and backfilling.

15234.4.3 SERVICE METER SETTER ASSEMBLY

Measurement of service meter setter assemblies shall be made by counting the number of each size of assembly furnished, installed, and accepted. This measurement shall include the curb stop meter

setter, connecting fittings, meter box, lid, drain gravel, and the necessary excavation and backfilling.

15234.4.4 WATER METERS

Measurement of water meters shall be made by counting the number of meters of each size furnished, installed, and accepted.

15234.4.5 STOCK WATERING TAPS

Measurement for stock watering taps shall be made by counting the number of each size of connection installed and accepted. This measurement shall include furnishing and installing: (1) service saddle on the water main; (2) drilling and tapping; (3) corporation stop; (4) 20-feet of service lateral; (5) curb stop and box; and (6) the necessary excavation and backfilling required to complete the connection.

15234.4.6 REPLACEMENT OF EXISTING FACILITIES

Where certain components of a total existing water service connection are to be replaced, measurement will be made by counting the number of each size and/or kind of the specifically identified component or components as shown in the Bid Schedule as installed and accepted. Such measurement shall include furnishing and installing the identified component, necessary excavation, and backfill, and salvaging and delivery of any replaced component when designated.

15234.5 BASIS OF PAYMENT

The accepted quantities shall be paid for at the contract unit price for:

PAY ITEM	UNIT
(*Size*) Service Connection	Each
(*Size*) Service Lateral	Linear Foot
(*Size*) Service Meter Assembly	Each
(*Size*) Meter	Each
Replace (*Size*) (*Component Name*)	Each
Install (*Size)(Component Name*)	Each
(*Size*) Stock Watering Tap	Each
(*Size*) Stock Watering Tap	Each

15238.1 DESCRIPTION

Includes furnishing and installing pressure gauges and their support piping and fittings in buildings and other structures at locations shown on the Drawings.

15238.1.1 RELATED WORK

Section 02222 – Waterline Pipe Installation
Section 15110 – Pipe and Piping Systems

15238.1.2 SUBMITTALS

The Contractor shall provide descriptive information which indicates the model number, manufacturer's name, dimensions, measuring range and manufacturer's certification of performance in accordance with the requirements of Section 01300.

15238.1.3 DEFINITIONS

Not used.

15238.2 MATERIALS

15238.2.1 PRESSURE GAUGES

Shall be US Gauge, Model 656, stem mounted and oil filled, as manufactured by AMETEK or an approved equal. Gauges have a 2 1/2-inch (minimum) stainless steel case with a pressure relief plug. The window shall be polycarbonate plastic with neoprene sealing gasket. The pressure reading range shall be as shown on the Drawings or as prescribed in the Special Provisions.

15238.2.2 SUPPORTING PIPE AND FITTINGS

Shall be 1/4-inch threaded Schedule 40 galvanized pipe.

15238.3 CONSTRUCTION REQUIREMENTS

Pressure gauges shall be installed in accordance with the manufacturer's recommendations and at the locations shown on the Drawings. The Contractor shall provide sufficient supporting pipe to mount pressure gauges vertically and oriented to be read easily. When possible, pressure gauges should be installed at least three pipe diameters downstream from any valve in the pipeline.

15238.4 METHOD OF MEASUREMENT

Separate measurement of pressure gauges and their supporting piping will not be made. Measurement will be included with the building or structure that it serves.

15238.5 BASIS OF PAYMENT

Separate payment for pressure gauges will not be made.

15300.1 DESCRIPTION

The Contractor shall furnish and install floor drains in structures of the size and type, and at the locations shown on the Drawings.

15300.1.1 RELATED WORK

Section 02222 – Waterline Pipe Installation
Section 02105 - Earthwork Materials

15300.1.2 SUBMITTALS

Not used.

15300.1.3 DEFINITIONS

Not used.

15300.2 MATERIALS

15300.2.1 DRAIN

Floor Drains shall be cast iron body, 6-inch (minimum) diameter heavy-duty grated type with a removable cast iron or stainless steel cover.

15300.2.2 PIPING

Drain piping shall be drain waste and vent (DWV) schedule 40 PVC pipe and fittings sized to fit the floor drain in accordance with the Drawings.

15300.2.3 P-TRAPS

P-traps, when required on the Drawings, shall meet the requirements of Schedule 40 PVC pipefittings sized to fit the drainpipe.

15300.2.4 DRAIN GRAVEL

Drain gravel for floor drain sumps, where applicable, shall meet requirements of Section 02105 and shall be installed as shown on the Drawings.

15300.2.5 CHECK VALVES

Floor drain check valve, when required by the Drawings, shall be a rubber slip-on check valve capable of draining drainpipe under low flows and low pressures. The valves shall require no maintenance or repair. The check valves shall be attached to the drainpipe by stainless steel clamps.

15300.3 CONSTRUCTION REQUIREMENTS

15300.3.1 SETTING DRAINS

Where floor drains are required, the floor will have been designed with a slope to a low point where the drain is to be placed. Typically, the floor drain will be cast in the low point in the floor at the time of installation of the floor. The Contractor shall take care to coordinate the setting of

the drain and the pouring of the concrete so that the top surface of the drain cover is flush with the floor surface to allow complete drainage of any water which accumulates on the floor.

15300.3.2 PIPE WORK

Piping shall be connected and run on a 1% minimum slope away from the drain as shown on the Drawings. Where termination of the piping is in drain gravel, care shall be taken to locate the pipe end in the top one-third of the gravel sump. Where termination of the piping is at daylight, the Contractor shall provide a 5-foot section of cast iron or ductile iron pipe, sized to match the drain pipe, at the daylight end of the pipeline so that the thermoplastic pipe will not be exposed to daylight.

15300.4 METHOD OF MEASUREMENT

15300.4.1 NO MEASUREMENT

Unless provided for as a separate bid item in the Bid Schedule, no separate measurement of the floor drain, its connecting piping, gravel sump, etc., will be made. Measurement of the drain will be included with the building or structure identified in the Bid Schedule.

15300.4.2 SEPARATE MEASUREMENT

When provided for in the Bid Schedule, the cost of all material and labor required of the floor drain assembly will be measured by counting the number of floor drain assemblies installed and accepted.

15300.5 BASIS OF PAYMENT

When a separate bid item is provided, complete compensation for this accepted work shall be included in the contract unit price on the Bid Schedule.

PAY ITEM	UNIT
Floor Drain Assembly	Lump Sum
Floor Drain Assembly	Each

CERTIFICATION(S)



DIVISIONS 26, 28 & 40

END OF SECTION 01 00 05

DIVISION 26

ELECTRICAL

SUNRISE
ENGINEERING

DIVISION 26 – ELECTRICAL

SECTION 26 00 00 – GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION includes requirements for electrical Work by this Contract.

B. The following administrative and procedural requirements are included in this SECTION to expand the requirements specified in DIVISION 1:
   1. Submittals.
   2. Coordination drawings.
   3. Record documents.
   4. Maintenance manuals.
   5. Rough-ins.
   6. Electrical installations.
   7. Cutting and patching.
   8. Touch-up painting.

C. Install and make suitable for operation equipment furnished by others per the Drawings and Specifications.

D. Provide Equipment as specified in DIVISION 26.

E. Furnish and install Material for electrical equipment and systems; including supports, conduit, fittings, wiring and connectors.

F. Furnish all Labor and Materials to complete the Work as specified in accordance with national, state and local governing bodies having jurisdiction.

G. All Equipment and Material shall be rated for the Project Site conditions as specified in DIVISION 1.

H. Provide all temporary construction power and lighting.

I. Provide skilled labor and technical assistance to manufacturer's service representatives for the configuration and startup of electrical Equipment and Systems.

J. Perform Work in the follow locations at the Project Site:
   1. Pump Station interior.
   2. Pump Station exterior.
   3. Potable and Reuse water tanks and duct bank in between.

K. Coordinate Work with others as specified in this SECTION PART 3 - EXECUTION.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. DIVISION 2 - Sitework
B. DIVISION 3 - Concrete.
C. DIVISION 4 - Masonry
D. DIVISION 9 - Finishes
E. DIVISION 10 - Building Specialties
F. DIVISION 11 - Process & Mechanical Equipment
G. DIVISION 14 - Special Mechanical Equipment
H. DIVISION 15 - Mechanical
I. SECTION 26 05 19 - Low-Voltage Conductors and Cables
J. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems

K. SECTION 26 05 29 - Hangers and Supports for Electrical Systems
L. SECTION 26 05 33 - Raceway and Boxes for Electrical Systems
M. SECTION 26 05 43 - Underground Ducts and Raceways for Electrical Systems
N. SECTION 26 05 44 - Sleeves and Sleeve Seals for Electrical Raceways and Cabling
O. SECTION 26 05 53 - Identification for Electrical Systems
P. SECTION 26 05 73 - Electrical Studies
Q. SECTION 26 08 10 - Electrical Testing and Maintenance
R. SECTION 26 22 13 - Low Voltage Distribution Transformers
S. SECTION 26 24 13 - Switchboards
T. SECTION 26 24 16 - Panelboards
U. SECTION 26 27 26 - Wiring Devices
V. SECTION 26 28 16 - Enclosed Switches and Circuit Breakers
W. SECTION 26 29 00 - Enclosed Controllers
X. SECTION 26 29 23 - Variable Frequency Motor Controllers
Y. SECTION 26 32 13 - Engine Generator Sets
Z. SECTION 26 35 26 - Harmonic Filters
AA. SECTION 26 36 00 - Transfer Switches
BB. SECTION 26 41 00 - Lightning Protection System
CC. SECTION 26 43 13 - Surge Protective Devices
DD. SECTION 26 50 00 - Lighting
EE. SECTION 40 05 93 - Common Motor Requirements for Water and Wastewater Equipment
FF. SECTION 40 60 00 - Process Control and Instrumentation General Requirements
GG. SECTION 40 70 00 - Instrumentation for Process Systems

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of the Issued For Construction (IFC) date of the Contract Documents unless otherwise indicated.
B. American National Standards Institute (ANSI)
C. ASTM International (ASTM)
D. Federal Information Processing Standards Publication (FIPS)
E. Insulated Cable Engineer's Association (ICEA)
F. Institute of Electrical and Electronic Engineers (IEEE)
G. National Electrical Contractors Association (NECA)
H. National Electric Manufacturers Association (NEMA)
I. National Electrical Installation Standards (NEIS)
J. National Fire Protection Association (NFPA)
    1. National Electrical Code (NFPA 70) – Latest Adopted Version
    2. Standard for Electrical Safety in the Workplace (NFPA 70E)
K. Telecommunications Industry Association (TIA)
L. Underwriter's Laboratories, Inc (UL)

1.05 DEFINITIONS:

A. Definition:
    1. Direct Buried: Installed underground without encasement in concrete or other protective material.
    2. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include, but are not limited to, the following:

a. Cabinet: An enclosure that is designed for either surface mounting or flush mounting or pad mounting. Cabinet is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
b. Conduit Body: A means for providing access to the interior of a raceway system through one or more removable covers at an outlet, conduit box or terminal point.
c. Conduit Box: A box having threaded openings or knockouts for conduit, flexible metal tubing, or fittings.
d. Device Box: A box with provisions for mounting a wiring device directly to the box.
e. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
f. Floor Nozzle: An enclosure used on a wiring system, intended primarily as a housing for a receptacle, provided with a means, such as a collar, for surface-mounting on a floor, which may or may not include a stem to support it above the floor level, and is sealed against the entrance of scrub water at the floor level.
g. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
h. Outlet Box: A box that provides access to a wiring system having pry out openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
i. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
j. Raised-Floor Box: A floor box intended for use in raised floors.
k. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.

3. Luminaire: A complete lighting unit consisting of a light source such as a lamp, together with the parts designed to position the light source and connect it to the power supply. It includes the parts to protect the light source and the driver to connect to the light source power supply.
4. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
5. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Refer to each SECTION of this DIVISION for specific Product Data, Shop drawing and additional Submittal requirements.
   1. Preliminary Short Circuit Study is to be submitted based on equipment intended to be provided. Short Circuit Study is to be approved prior to purchase orders for equipment being released/issued. Equipment where the specified short circuit current ratings are not sufficient shall be explicitly noted and recommendations shall be made to achieve proper equipment ratings.
C. Product Data, manufactured equipment:

1. Include data specification sheets, equipment cut sheets, outline drawings, electrical equipment ratings for pressure temperature and voltage.

D. Shop Drawings, fabricated equipment:
   1. Include fabrication drawings, connection point size type and rating, field wiring and ratings for pressure, temperature, power, current and voltage.
   2. Clearly specify any components not provided with requirements required for safe and proper operating of equipment.

E. Coordination Drawings: in accordance with DIVISION 1, for equipment rooms, and other congested areas to a scale of 1/4 inch=1 foot-0 inch, or larger if required. Detail major electrical Systems, Equipment and Material indicated on floor plans and section detail. Check for interferences with architectural, structural or mechanical systems, installations, and building components. Do not allow electrical systems to be installed where plumbing or water systems are above electrical systems. Drawings shall indicate where space is limited for installation, maintenance access, working clearances. Drawings shall indicate where sequencing and coordination of Work is important for efficient flow of the Work and to reduce any rework. At a minimum include:
   1. Elevation size and route of cable trays and raceways.
   2. Relationships and clearance distances between components and adjacent architectural, structural, electrical, and mechanical elements.
   3. Working clearances for equipment, including space for equipment disassembly required for periodic maintenance.
   4. Exterior wall, floor, and foundation penetrations.
   5. Fire-rated wall and floor penetrations.
   6. Equipment connections and support details.
   7. Size and location of concrete pads, footers and bases.
   8. Support details.
   9. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
   10. Elevations, sizes of sleeves to indicate penetrations in floors, walls, and ceilings, and their relationship to other penetrations and installations.
   11. Elevation of ceilings and ceiling components to coordinate and integrate installations, air outlets, air inlets, light fixtures, communications systems' components, sprinklers, heat detectors, smoke detectors, motion detectors, speakers, access panels and other ceiling-mounted devices.
   12. Coordinate chases, slots, inserts, sleeves, and openings with electrical equipment. In general, verify all panel connections align with each other and with other equipment where possible.

F. As-Built Records:
   1. Redline all Contract Drawings and Shop Drawings to indicate changes after Issued For Construction (IFC) set of drawings.
   2. Include:
      a. Major raceway systems (2” conduits and above, or groupings of 4 or more conduits of any size), size and location for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; disconnects, fuse size and location, circuit breaker sizes and arrangements.
      b. Equipment locations dimensioned from prominent building lines.
      c. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
   3. Including changes resulting from:

a. Requests for Information (RFI).
b. Purchase Change Orders (PCO).
c. Engineering Change Notices (ECN).
d. Requests for substitution or alternate products.

G. Operation and Maintenance (O&M) manuals: in accordance with SECTION 01200 - Contract Closeout. In addition to the requirements specified in DIVISION 1, include the following:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data, tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; lockout/tagout procedures; and summer and winter operating instructions.
3. Maintenance procedures for routine preventive maintenance and troubleshooting; disassembly, repair, reassembly; aligning and adjusting instructions.
4. Product Data
5. Shop Drawings
6. Servicing instructions, lubrication charts and schedules.
7. As-Built Records.

H. Field quality-control reports.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C700-7.13.
B. Packing, shipping, receiving and onsite storage:
1. Deliver products to the Project Site properly identified with names, model numbers, types, grades, compliance labels, and Engineer’s Tag Number indicated on the Contract Drawings.
2. Protect all Equipment shipment from moisture and physical abuse which may cause:
a. Damage to movement, mechanisms, or electronics.
b. Corrosion.
c. Reduced normal operating life.
3. Protect all Equipment connections including, but not limited to, motor electrical connections with suitable end covers to prevent entrance of foreign material.
4. Handle, package, and store all equipment according to the manufacturer’s recommendations and requirements.

1.08 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. Tests, inspections: At the shop, factory, plant, or place of manufacture.
C. Installer Qualifications:
1. Contractor shall have electrical experience in the Water and Wastewater industry for at least 5 years performing similar type of work described in the Contract Documents.
D. Verification of performance:
1. All Equipment and Material designs furnished shall be identical to equipment and material designs having an acceptable history of domestic service for a period of not less than three years at comparable temperature, voltage, and design stress levels.
2. Equipment and Material designs with less than three years of actual service will be considered from established manufacturers but shall be furnished only if accepted by Engineer and Owner prior to award of Contract.

E. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

1.09 COORDINATION, SEQUENCING AND SCHEDULING:

A. Sequence equipment installation work with other work to minimize possibility of damage and soiling during remainder of construction period.
B. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.10 PROJECT SITE CONDITIONS:

A. Approximate Site Location: Green River, WY
B. Altitude = 6000 feet above mean sea level.
C. Minimum and maximum outdoor ambient temperature range = -20 ºF - 105ºF.
D. Minimum and maximum indoor non-conditioned temperature range = 50ºF - 110ºF.
E. Minimum and maximum indoor conditioned temperature range = 50ºF - 85ºF.
F. Maximum Outdoor Relative Humidity = 100%.
G. Seismic Factors: Refer to Structural.

1.11 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.
D. Contractor shall provide written notification to Owner prior to this warranty start date.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Furnish and install Materials in accordance with NEC and NFPA 70E.
B. All components and Material shall be new and free of defects using UL recognized components.
C. All electrical Equipment, motors, panels, systems and skids shall be UL listed.
D. Fabricated panels and skids in accordance with applicable NEMA and UL standards.
E. All equipment conductor termination provisions and equipment lugs shall be UL listed for 75ºC.
F. Identify and label with permanent labels all Equipment and Material used to complete this Work. Labels clearly indicating design intent in accordance with the Contract Drawings and as specified in DIVISION 26.
G. Perform all Work Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

2.02 SYSTEMS:

A. Furnish, install and make suitable for operation the following systems:
    1. 480V, 3-phase, 60 hertz, 4-wire & 3-wire power distribution system.
    2. 208/120 V, 3-phase, 60 hertz, 4-wire: lighting, receptacle power, and small power system.
    3. Grounding and bonding system.
    4. Natural Gas engine-generators.

5. Ethernet Network components.
6. Security components.
7. Lightning Protection System
8. Lighting systems.

2.03 ELECTRICAL MATERIAL SERVICE REQUIREMENTS, ENVIRONMENTAL RATINGS:

A. Refer to Electrical Drawing 00E-003.

PART 3 - EXECUTION

3.01 GENERAL

A. Perform all Work in accordance with:
   1. NEC and NFPA 70E.
   2. NECA National Electrical Installation Standards (NEIS)
B. Perform all Work necessary to furnish, receive, store, install, connect, tube, wire, pipe and commission electrical equipment:
   1. In strict accordance with the manufacturer's recommendations.
   2. To power and operate the systems and process.
   3. As specified and indicated on the motor schedule, equipment schedule, valve schedule, Process and Instrumentation diagrams (P&IDs), and Electrical Drawings.
C. Provide all Material to mount on floor or wall.
D. Concrete work for all electrical equipment pads, foundations, duct banks and other DIVISION 26 applications shall conform to DIVISION 3 – Concrete.
   1. Provide concrete mounting pads for equipment located outdoors.
   2. Provide housekeeping pads for Equipment located indoors.
E. Install systems, Equipment and Material level, plumb, parallel, and perpendicular to other building systems and components, where installed in finished spaces.
F. Install electrical Equipment and Material to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations.
G. Install raceways, cables, and wireways clear of obstructions and clear of the required working space of equipment.
H. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
I. Provide all equipment, materials, scaffolding, rigging, and tools to complete the Work.
J. Provide all labor, including expert and common, specialized personnel, fitters, electricians, and attendance of such personnel.
K. Electrical Plan Drawings shall be used to determine approximate location of Equipment to be installed and cable lengths. Contractor shall advise the Engineer of interferences.
L. Equipment not indicated on the Electrical Plan Drawings but listed in Equipment schedules, shall be field-located by the Contractor with the assistance of the Engineer.
M. Install permanent equipment labels for all Equipment, Material and devices or as directed by the Engineer.

3.02 COORDINATION AND SCHEDULING:

A. Coordinate all installation activities involving others. Identify restraints caused by others which affect performance of the Work. Resolve such restraints where possible and notify the Engineer when additional action is required to complete the Work.
B. Provide a complete construction sequence document to:

1. List construction milestones
2. List electrical commissioning activities
3. Outline the needs for temporary construction power

C. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide the required connection for each service. Include necessary application and utility construction fees.

3.03 PREPARATION:

A. Verify existing Site conditions match the specifications.

B. Verify the Contract Documents are consistent with the existing equipment and material installation. Notify Engineer of discrepancies.
1. Verify all existing dimensions by field measurements.
2. Arrange for chases, slots, and openings in other building components during progress of construction to allow for electrical installations.
3. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.

C. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building. Coordinate concrete pads, bases, roof curbs, and related items.

D. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

E. Refer to equipment specifications in DIVISIONS 10 through 40 and the equipment submittals for rough-in requirements.

3.04 INSTALLATION:

A. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Should coordination requirements conflict with individual system requirements, Notify the Engineer of any conflicts.

B. Where mounting heights are not specifically detailed, specified, or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

C. All electrical equipment and installations shall be of adequate strength to withstand, without failure, forces encountered in defined Seismic conditions.

D. For equipment provided by this Contractor, the design indicates a variety of motor horsepower/kilowatt ratings, over current protection device ratings (circuit breakers or fuses), and conductor sizes. These sizes are to be considered approximate and are to be coordinated with final sizing and ratings of equipment included in approved submittals; if the Contractor installs a different size or type, then at no additional cost to the Owner, the Contractor shall provide components, Equipment, and Materials as recommended by the equipment manufacturer or as required to stay compliant with the NEC. Including but not limited to:
1. Fuses or circuit breakers.
2. Motor controllers.
3. Conduit.
4. Cables.
5. Cable Lugs.
6. Disconnects.
7. Power Distribution Equipment.

3.05 TESTING:

A. Test all electrical Equipment upon completion of installation to ensure that the Equipment operates satisfactorily to the Owner and conforms to Contract Documents.

B. Furnish temporary power sources of proper type for testing purposes when normal supply is not available at the time of testing.

3.06 FINISHES:

A. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit degree of damage at each location.

B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

C. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

D. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

E. Repair damage to protective coatings in accordance with SECTION 09910 - Protective Coatings.

3.07 CLEANING:

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

3.08 PROTECTION:

A. Protect equipment and installations and maintain conditions to ensure that coatings, finishes and cabinets are without damage or deterioration at time of Substantial Completion.

3.09 CLOSEOUT:

A. Instructions, training, and manufacturer’s service representative:

1. Provide on-site instructions and training of Owner's personnel as specified.
2. Provide on-site services of a manufacturer's authorized service representative as specified.

3.10 LUMP SUM:

A. Measurement for DIVISION 26 shall be made as lump sum to include, but not be limited to, building permits, utility service applications and related installation requirements, electrical equipment, generator electrical enclosures, motor controllers, disconnects, wiring devices, raceways, power/controls/network cabling and wiring, lighting, and coordination with Owner's System Integrator.

END OF SECTION 26 00 00

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION includes the requirements for furnishing and installing (including terminations) all low-voltage electrical conductors, cable, and accessories.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 00 00 - General Electrical Requirements
B. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems
C. SECTION 26 05 33 - Raceway and Boxes for Electrical Systems
D. SECTION 26 05 43 - Underground Duct Banks and Manholes
E. SECTION 26 05 44 - Sleeves and Sleeve Seals for Electrical Raceways and Cabling
F. SECTION 26 05 53 - Identification for Electrical Systems
G. SECTION 40 70 00 - Instrumentation for Process Systems.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of the date of the Contract Documents unless otherwise indicated.
B. ASTM International (ASTM):
    1. ASTM B3 – Standard Specification for Soft or Annealed Copper Wire.
    2. ASTM B8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
    3. ASTM B33 – Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.
    4. ASTM B172 – Rope-Lay Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors.
C. Insulated Cable Engineers Association (ICEA):
    1. ANSI/ICEA S-81-570 – 600Volt Rated Cables of Ruggedized Design for Direct Burial Installations as Single Conductors or Assemblies of Single Conductors.
    2. ANSI/ICEA S-105-692 – 600Volt Single Layer Thermoset Insulated Utility Underground Distribution Cables.
D. Institute of Electrical and Electronics Engineers (IEEE):
    1. IEEE 1202 – Flame-Propagation Testing of Wire and Cable.
E. International Electrical Testing Association (NETA):
    1. ANSI/NETA ATS – Acceptance Testing Specifications for Electrical Power Equipment and Systems.
F. National Electric Manufacturers Association (NEMA) and Insulated Cable Engineers Association (ICEA):
    1. ANSI/NEMA WC 53/ICEA T-27-581 – Standard Test Methods for Extruded Dielectric Power, Control, Instrumentation, and Portable Cables for Test
    2. NEMA WC57/ ICEA S-73-532 – Standard for Control, Thermocouple Extension, and Instrumentation Cables.
    3. ANSI/NEMA WC 70/ICEA S-95-658 – Nonshielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy
G. National Fire Protection Association (NFPA):

1. NFPA 70 – National Electrical Code (NEC).

H. Underwriters Laboratories, Inc. (UL):
1. UL 44 – Thermoset Insulated Wires and Cables.
2. UL 83 – Thermoplastic Insulated Wires and Cables.
3. UL 854 – Service Entrance Cables.
4. UL 1581 – Reference Standard for Electrical Wires, Cables, and Flexible Cords

1.05 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJDCD C-700.7.16 Submittals.

B. Product Data: For each type of product submit the following marked for intended location and use:
1. Data sheets for each wire and cable type specified.
2. Data sheets for wire and cable accessories.
3. Cable manufacturer's approval of splicing and terminating materials.
4. Cable manufacturer's approval of pulling compounds.
5. Cable manufacturer's installation requirements such as maximum pulling tensions, sidewall pressures, minimum bending radii, and other considerations.
6. Other Equipment and Materials to be used.

C. Special Procedure Submittals:
1. Test Plan:
a. Provide a complete and detailed test plan for network cabling system including a complete list of test equipment.
2. Include procedures for certification, validation, and testing.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C700-7.13.

1.07 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

B. Factory Tests:
1. Quality Control Test Protocol: The manufacturer shall conduct tests according to industry standard requirements. These tests shall be performed routinely on sample sizes sufficient to verify quality and continuity or as specified.

C. Installer Qualifications:
1. Prior to installation, submit data of installer's experience and qualifications.
2. Network equipment installers shall be a Building Industry Consulting Service International (BICSI) Registered Cabling Installation Technician or have experience which shall include 3 years on projects of similar complexity.
3. Include written certification from previous clients where systems have performed satisfactorily for not less than 18 months.
4. Include specific experience in installing and testing structured communications distribution systems using managed Ethernet switches, and Category 6 and fiber optic cabling systems included in the design.

1.08 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.

B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Cable Connectors for Control and Instrument Cable:
   1. TE Connectivity Ltd.
   2. Hollingsworth Solderless Terminal Company.
   3. Panduit Corporation.
   4. 3M Company.
   5. Thomas and Betts Company, Inc.
B. Cable Connectors for Power Cable:
   1. TE Connectivity Ltd.
   2. Thomas and Betts Company, Inc.
   3. 3M Company.
   4. Panduit Corporation.
C. Termination and Splice Kits:
   1. 3M Company.
   2. Raychem.
D. Shielded VFD Power Cables:
   1. Belden, See Drawings for basis of design catalog numbers.
   2. Engineer approved equal.
E. Shielded VFD Power Cable Termination Kits:
   1. Service Wire Company.
   2. Southwire Company LLC.
F. Tape and Insulation Putty:
   1. 3M Company.
G. Cable Ties:
   1. TE Connectivity Ltd.
   2. Avery-Dennison Corporation.
   3. Panduit Corporation.
   4. 3M Company.
   5. Thomas and Betts Company, Inc.
H. Cable Supports:
   1. Emerson - O. Z./ Gedney Company.
   2. Hubbell, Kellems Grips.
I. Terminal Blocks:
   1. Allen Bradley.
   2. Buchanan.
   3. Phoenix Contact.
   4. Square D Company.
   5. Weidmuller.
J. Cable Identification Tags:
   1. Refer to SECTION 26 05 53.
K. Fiber-Optic Cables:
   1. Corning Optical Communications.

a. Basis of Design: Indoor/Outdoor 50µm FREEDM One Riser Rated Tight-Buffered, Interlocking Armor
2. Approved Equal

L. Fiber-Optic Cable Connectors, Duplex Jumpers, Patch Panels and Accessories:
1. AFL.
2. Avaya Inc.
3. Black Box Corporation
4. Corning Optical Communications.
5. Optical Cable Corporation.
6. Ortronics, Legrand.
7. Panduit.

2.02 WIRE AND CABLE:

A. General:
1. All cables surface printing on the cable shall show manufacturer's name, cable type and size, number of conductors, insulation type, and Underwriters Laboratories (UL) Listed.
2. All cable shall be tested and certified to be in conformance with UL1581 and UL 1685 for the following:
a. Flame exposure
b. Riser cable
c. Crush
d. Impact
e. Flex
f. Pull
3. Provide wiring as indicated below. For location and area classification refer to SECTION 26 00 00, Electrical Material Service Requirements.
a. For cables, size #6 AWG and smaller, routed only through dry environments, cable insulation shall be:
(1) Polyvinyl chloride "PVC" and rated as Type THHN/THWN.
(2) Nylon outer jacket outdoor rated Sunlight Resistant, and Oil Resistant.
(3) THHN/THWN tested and certified to be in conformance with UL 83.
b. For cables size #4 AWG and larger routed through dry environments, and all cables routed through a wet or corrosive environments, cable insulation shall be:
(1) Cross-linked polyethylene "XLPE" and rated as Type XHHW-2.
(2) XHHW-2 tested and certified to be in conformance with UL 44.
c. All cables shall be suitable for operation under the following maximum conductor temperatures:
(1) 90°C --- Continuous, dry locations
(2) 75°C --- Continuous, wet locations
d. For corrosive environments all conductors and terminations should be tin coated.
4. All thermocouple extension cables shall be tested and certified to be in conformance with ANSI/NEMA WC 57.

B. Communication Cables: As specified in the Cable Schedule.
1. Refer to AIC Drawing Process Control Networks.

C. Control Cables: As specified in the Cable Schedule.
1. All Control and Instrument cables shall be tested and certified to be in conformance with ANSI/NEMA WC 53.
2. 600 V RMS.

3. Conductor Size #14 AWG.
4. Cross-linked polyethylene insulation
5. Where required, provide a designated neutral conductor.
6. Provide cables with shields based on application:
    a. Unshielded for 120 VAC control signals.
    b. Shielded for 24 VDC analog and discrete control signals. Aluminized mylar or polyester tape and tinned copper drain wire.
7. Single conductor cable:
    a. Class B stranded annealed copper.
8. Multi conductor cable:
    a. Type TC
    b. Class B or C stranded annealed copper.
    c. Color coding shall be Method 1 (NEMA WC57/ICEA S 73-532 Appendix E, Paragraph. E3.1) using color pigmented compounds with colors as designated by Table E-2 (K-2).
    d. Polyvinyl chloride “PVC” outer jacket and rated for outdoor use.

D. Fiber Optic Cables: as specified in the cable schedule
1. Provide fiber with number of strands as indicated on the cable schedule.
2. All cable supplied shall meet the flame test requirements of UL 1666 and the crush, impact, and flex resistance test requirements of TIA-455-41 and flex resistance testing TIA-455-104.
3. ICEA-S-83-596, ICEA-S-104-696 , ANSI/TIA-568.3-D, UL Listed Type OFNR (UL 1666) and FT4, NEC Section 770.179(b) OFNR for use in vertical runs in building riser shafts from floor to floor.
4. Provide fiber optic cables with interlocking armor and flame retardant overall jacket.
5. Provide Fiber type based on the length of run, as determined on the drawings, or equipment provided:
    a. Less than one mile: Multimode
        (1) Distribution class grade.
        (2) 900 micrometer Tight Buffered low smoke PVC.
        (3) Acrylate Fiber Coating. Water Blocking Aramid Yarn Strength Members.
        (4) Flame retardant PVC for riser applications.
        (5) Indoor/Outdoor water and fungus resistant PVC outer jacket with rip cord.
        (6) OM3 ISO/IEC 11801 with Core Cladding Diameter 50 micrometer, color coding according to TIA-598-C. 10 Gb/s.
        (7) Max attenuation 3.5 db/km @ 850 / 1.5 db/km @ 1300nm

E. Ground Conductors: Applies to all cables as specified in SECTION 26 05 26 - Grounding and Bonding for Electrical Systems and as indicated on the electrical Grounding Drawings.
1. Annealed, tinned bare copper
2. Solid in sizes #4 AWG and smaller. (ASTM B3)
3. Class B stranded in sizes #2 AWG and larger (ASTM B8)

F. Instrument Cables: As specified in the Cable Schedule
1. All Control and Instrument cables shall be tested and certified to be in conformance with ANSI/NEMA WC 53.
2. 600 V RMS.
3. Conductor Size #16 AWG twisted shielded pair.
4. Class B or C stranded annealed copper.

5. Color coding shall be Method 1 (NEMA WC57/ICEA S 73-532 Appendix E, Paragraph. E3.1) using color pigmented compounds with colors as designated by Table E-2 (K-2).
6. Polyvinyl chloride "PVC" and rated for outdoor use.

G. Power Cables: Applies to all cables to provide power for Wiring Devices and Lighting fixtures and as specified in the Cables schedule.
1. All Power cables shall be tested and certified to be in conformance with ANSI/NEMA WC 70.
2. Individual conductors or multi-conductor cables shall be identified by means of solid colors, stripes, or printing, and in accordance with NEMS WC 70.
3. Conductor sized as specified in the cable schedule, with a minimum of #12 AWG or larger.
4. Single conductor cable shall be used as specified in the cable schedule, outdoors and in underground duct bank applications:
   a. Class B stranded annealed copper.
5. Multi conductor cable shall be used indoors:
   a. Class B or C stranded annealed copper.
   b. Polyvinyl chloride "PVC" outer jacket and rated for outdoor use.
6. Multi conductor cables intended to be used for variable frequency drive applications to use cables specifically designed for variable frequency applications. Refer to plans for equivalent Belden brand part numbers.
7. Metal clad:
   a. Type MC
      (1) Class B or C stranded annealed copper
      (2) Class B stranded insulated copper ground conductor sized in accordance with Table 5-2 NEMA WC70/ICEA S-95-658
      (3) Conductors cabled together, binder tape bearing the print legend wrapped around the assembly, and an aluminum interlocked armor applied over the assembly.

H. VFD Cables:
1. As specified in the Cable Schedule, or approved equal.
2. All Power and VFD cables shall be tested and certified to be in conformance with ANSI/NEMA WC 70.
3. Individual conductors or multi-conductor cables shall be identified by means of solid colors, stripes, or printing, and in accordance with NEMS WC 70.
4. Three symmetrical Class B stranded bare copper ground conductors sized in accordance with Table 5-2 NEMA WC70/ICEA S-95-658.
5. Copper tape shields with 100% coverage.
6. Polyvinyl chloride "PVC" oil resistant jacket, rated for outdoor use.

2.03 CONNECTORS:

A. General Requirements:
1. Designed and sized for specific cable being connected.
2. Solderless, pressure type connectors constructed of non-corrodible tin-plated copper.
3. Application tooling for connectors shall contain die or piston stops to prevent over crimping and cycling or pressure relief to prevent under crimping. Dies of all application tooling shall provide dot or wire size coding for quality control verification. All tooling shall be manufactured by the connector manufacturer.

B. Power Connectors (#10 AWG and Smaller) 600V and Below:

1. "Scotchlok" pre-insulated spring wire connectors.
2. Buchanan open end copper splicing caps, applied with "Lok Seal" tool, with nylon snap on insulators.

C. Power Connectors (sizes #8 to #4 AWG) 600V and Below:
1. Non-insulated ring tongue type.
2. Ring tongue sized to match terminal stud size.
3. Brazed barrel seam.
4. Application tooling designed to crimp the wire barrel (conductor grip) with a one-step crimp.

D. Power Connectors (sizes #2 AWG to 750 MCM) 600V and Below:
1. Non-insulated one hole rectangular tongue for sizes #2 AWG through #3/0 AWG and two hole rectangular tongue for #4/0 AWG through 750 MCM.
2. Acceptable manufacturers' cross reference chart is listed at end of this SECTION.

E. Power Connectors (sizes #2 AWG to 750 MCM) above 600V:
1. Non-insulated one hole rectangular tongue for sizes #2 AWG through #3/0 AWG and two hole rectangular tongue for #4/0 AWG through 750 MCM.
2. Voltage rating equal or greater than that of the cable being used.
3. Application tooling shall be hydraulically operated.

F. Control, Instrument, and Specialty Cable Connectors:
1. Tin-plated copper.
2. Vinyl or nylon pre-insulated ring tongue type. Spade lugs will not be permitted.
3. Vinyl pre-insulated spring type spade terminals. (Hollingsworth "Mini Spring Spades"; Thomas and Betts "Locking Fork"; Panduit "Locking Fork.")
4. Sized to match terminal stud size.
5. Have insulation grip sleeve to firmly hold to cable insulation.
6. Insulation grip sleeve shall be funneled to facilitate wire insertion and prevent turned back strands.
7. Application tooling designed to crimp the wire barrel (conductor grip) and the insulation grip sleeve with a one-step crimp.

2.04 MOTOR LEAD TERMINATION/SPLICE (LOW VOLTAGE, 600 V AND BELOW, POWER CABLE):

A. Splices shall be made using compression type connectors bolted together. The compression type connectors shall be properly sized for the cables. Reference acceptable connector manufacturer's cross reference chart.

B. Splice to be covered with heat shrinkable tubing connector insulators or slip-on rubber boot or sleeve.

C. Splicing shall be done in accordance with the instructions provided with the Raychem brand MCK Motor Connector Kit or 3M Company 5300 Series Motor Lead Splice Kit.

2.05 CABLE SUPPORTS:

A. Cable supports for cables in vertical conduit risers shall be Emerson – O.Z. Gedney Type "R" wedging plug type or approved equal.

B. Kellems stainless steel, basket-type wire mesh grip for cables where indicated.

2.06 CABLE TIES:

A. Nylon self-locking type.

B. Have a normal service temperature range of 40°C to 85°C.

C. Be weather resistant type for outdoor use.
D. TE Connectivity "AMP TY," Avery-Dennison "BAR LOK," Panduit Corporation "PAN TY," Thomas & Betts "TY RAP," or 3M Brand cable ties.

2.07 TERMINAL BLOCKS:

A. For mounting in terminal boxes (TBs):
   1. Designed and sized for the cables being terminated.
   2. Block rated 600V.
   3. Binding screw type terminals for power cables and strap screw or tubular clamp terminals for control and instrument cables.
   4. Rated current carrying capacity equal to or greater than the cable being terminated.
   5. Marking strip.

B. For Mounting in Cabinets, Panels, Control Boards, etc.:
   1. Designed and sized for the cables being terminated.
   2. Block rated 600V.
   3. Binding screw type terminals for power cables and current transformer circuits and strap screw or tubular clamp terminals for control and instrument cables.
   4. Rated current carrying capacity equal to or greater than the cable being terminated.
   5. Marking strip on blocks for power cables and control and instrument cables.
   6. Short circuit strips with one shorting screw for each terminal for current transformer circuits.
   7. Shorting type terminal blocks rated for #10 AWG shall be used for all cables connected to current transformers (CTs).

2.08 CABLE IDENTIFICATION TAGS:

A. Provide cable identification tags as specified in SECTION 26 05 53.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General Requirements:
   1. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
   2. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
   3. Install in conduit, duct system, or direct burial as indicated.
   4. Cable shall not be subjected to pulling tensions or sidewall pressures in excess of the manufacturer's recommendations.
   5. Attach pulling grips over the cable sheath to prevent slipping of the insulation.
   6. Do not subject cable to bending radius less than those recommended by the cable manufacturer or as noted below (whichever is greater) during or after installation:
      a. Eight times the cable outside diameter for 600V or lower rated cables.
   7. Install intermediate pull boxes as indicated or as required to avoid subjecting cable to excessive pulling tension or sidewall pressures.
   8. Support cables at connections or termination points such that any strain on cable will not be transmitted to the connection or termination.
   9. Install cable supports in vertical runs of conduit, at boxes and at terminations in equipment, and as required to meet intermediate support requirements of National Electrical Code (NEC).

10. All pulling compounds shall be approved by wire and cable manufacturer as being compatible with cable materials.
11. Attach a cable identification tag to each cable at all termination or end points.
12. Install fire and smoke stop fittings at all cable penetrations of fire rated walls, floors, and ceilings.
13. Install conduit seals for conduits that terminate in a junction box located in an area identified as Hazardous (Classified) Location on the Contract Drawings.

B. Power (600V and Below), Control, Instrument, and Specialty Cable:
1. Install metallic barrier in all boxes to separate power, control, and instrumentation from low level signal (50V or less) instrumentation circuits where run in the same tray or box.
2. Tie together with cable ties all single conductor cable on each individual circuit in each junction box, or equipment at intervals not to exceed 6 feet.
3. Attach a cable identification tag to each cable.
   a. At each terminal to identify the circuit and cable.
   b. Attach fiber tags with cable ties.
   c. Use nylon ties and identification tabs color coded as follows:
      (1) 480V circuits – Red.
      (2) 277, 240, or 208Vac circuits – Orange.
      (3) 120V circuits – White.
      (4) Control cables – Natural Nylon.
4. Insulation Color Coding for Phase Identification:
   a. Color code 600-volt insulated, service entrance, feeder, and branch circuit conductors with factory-applied colored insulation for #8 AWG and smaller (except: #6 AWG and smaller for green ground wire); 1-inch band of colored tape at all splices and terminations for #6 AWG and larger (except: #4 AWG and larger for green ground wire) as follows:

Phase	240/120 Volts	480Y/277 Volts
A	Black (Line 1)	Brown
B	Red (Line 2)	Orange
C	N/A	Yellow
Neutral	White	Gray
Ground	Green	Green

   b. Tag each individual conductor or wire with wire markers as follows:
      (1) With terminal designation indicated on schematic diagrams or given on manufacturer's equipment drawings.
      (2) At each terminal.
      (3) In addition to specified circuit tags.
   c. Terminate and ground, control, instrument, and specialty cable shields as indicated and recommended by the manufacturer of the equipment being connected. In general, ground the shields at the control panels.
   d. Intermediate cable splices shall not be allowed when installing power, control, and instrument wiring except when spicing to lead wires provided with the equipment or device, or unless approved by the Engineer prior to cable installation.
   e. Control and instrument and thermocouple cable splices shall be as follows:
      (1) Made only in junction or terminal boxes.
      (2) Made on terminal blocks with marking strips.

(3) Conductor color coding shall be maintained.
(4) For shielded cables, shield continuity and isolation shall be maintained.
(5) Thermocouple cable splices to be made only on terminal blocks which correspond to thermocouple type used.

f. Power cable (600V or below) splices and motor terminations shall be as follows:
(1) Made only in junction or terminal boxes.
(2) Splices shall be made using compression type connectors bolted together.
(3) Splice to be covered with a heat shrinkable connector insulator.

g. High-Temperature Wiring:
(1) Install from device to a terminal box for all devices which by their location have the body of the device or electrical connection subject to ambient temperatures in excess of 185°F. Typical locations are feed water heaters, burner fronts, boiler penthouse, and deaerator.
(2) Locate terminal box far enough from the source of heat so that the temperature does not exceed 175°F. This distance generally is between 3 and 5 feet.
(3) Replace with high-temperature wire any wiring installed by this Contract that is damaged by excessive heat.

5. Lighting Cable: Install as specified in DIVISION 26.
6. Ground Cable: Install as specified in DIVISION 26.
7. Control and Instrument Cable: Install as specified in this SECTION.
8. Communications Cable: Install as specified in this SECTION.

C. Cable Connections and Terminations:
1. Make up clean and tight to assure a low-resistance joint.
2. Make only in terminal boxes, equipment, or other accepted enclosures and not in conduit.
3. Install all connectors with tooling manufactured by the connector manufacturer and as specified.

3.02 FIELD QUALITY CONTROL:

A. Perform tests and inspections and prepare test reports. Submit test reports as specified.

B. General Requirements:
1. Perform tests described below and per SECTION 26 08 10.
2. Test all wire, cable, and electrical equipment installed or connected by Contractor to assure proper installation, setting, connection, and functioning as indicated or to conform to Contract Documents and manufacturer's instructions.
3. Conduct all tests except megger insulation testing in the presence of Engineer and/or Owner and under the supervision of Equipment manufacturer's field engineer.
4. Include all tests recommended by the Equipment manufacturer unless specifically waived by Engineer.
5. Include all additional tests issued by Engineer that he deems necessary because of field conditions to determine that Equipment and Material and systems meet requirements of Contract Documents.
6. Include all tests recommended by the NETA Acceptance Testing Specifications.
7. The contractor shall be responsible for all damage to Equipment or Material due to improper test procedures or test apparatus handling.

C. Cable Testing Requirements:
1. Megger all 600V insulated power cable with a 1000Vdc megger for one minute, and values must not be less than 50 megohms per NETA ATS 7.3. Determine the values with

all switchboards, panelboards, fuse holders, switches, and overcurrent devices in place. Do not connect motors and transformers during meggering. Megger wire and cable after installation and not on the cable reel.

2. Cables with conductors failing this test shall be removed and replaced.
3. Provide all phasing tests and make all changes necessary to assure proper rotation of all motors, the correct phasing and phase sequence of all circuits susceptible to being paralleled, the proper polarity on all instrument transformer wiring, and such other phasing tests as may be required for the equipment being connected under this Contract.

D. 600V Control Cable:
1. Check all control cable for rightness of terminal contacts.
2. Megger the specific control cables selected by Resident Project Representative, or Engineer. The quantity of cables required to be meggered will not exceed 10% of the control cable installed by this Contract. Megger as described for 600V power cable after installation, but with cables disconnected from control panels and other equipment.
3. All control cables shall have a continuity check performed on each conductor to ensure the conductance of each wire before the wires are terminated.
4. Cables with conductors failing this test shall be removed and replaced.

E. 300V Instrument Cable:
1. Megger the specific instrument cables selected by Resident Project Representative, or Engineer. The quantity of cables required to be meggered will not exceed 10% of the instrument cable installed by this Contract. Insulation resistance shall be a minimum of 1,000 megohms per 1,000 feet.
2. All instrument cables shall have a continuity check performed on each conductor and shield to ensure the conductance of each wire and shield before the wires are terminated.
3. Cables with conductors or shields failing this test shall be removed and replaced.

F. Quality Assurance:
1. Test Reports:
   a. Submit as specified in DIVISION 1.
   b. Maintain a written record of all tests showing date, personnel making tests, equipment used, Equipment or Material tested, tests performed, and results.
   c. Notify Engineer two weeks prior to commencement of all testing except for megger tests.

3.03 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION specifies electrical grounding and bonding Work by this Contract.
B. Provide a grounding system as indicated on Drawings and schedules and as specified herein.
C. Ground each System specified in SECTION 26 00 00 PART 2 SYSTEMS. To protect the systems from lightning, line surges or high voltage to stabilize the systems.
D. Bond each conduit and electrical equipment enclosure with the source to create a low impedance ground-fault current path facilitating operation of the overcurrent protection devices.
E. Type of electrical grounding and bonding Work specified in this SECTION includes solidly grounded systems.
F. Applications of electrical grounding and bonding Work in this SECTION includes the following:
    1. Metal water piping.
    2. Electrical power systems.
    3. Grounding electrodes.
    4. Ground test wells.
    5. Counterpoise grounding ring.
    6. Separately derived systems.
    7. Raceways.
    8. Service equipment.
    9. Boxes and enclosures.
    10. Equipment.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. DIVISION 2 - Sitework
B. DIVISION 10 - Building Specialties
C. SECTION 26 00 00 - General Electrical Requirements
D. SECTION 26 05 19 - Low-Voltage Conductors and Cables
E. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems
F. SECTION 26 05 29 - Hangers and Supports for Electrical Systems
G. SECTION 26 05 33 - Raceways, Boxes, Seals, and Fittings for Electrical Systems
H. SECTION 26 05 43 - Underground Duct Banks and Manholes
I. SECTION 26 05 44 - Sleeves and Sleeve Seals for Electrical Raceways and Cabling
J. SECTION 26 05 53 - Identification for Electrical Systems
K. SECTION 26 08 10 - Electrical Testing and Maintenance
L. SECTION 26 22 13 - Low Voltage Distribution Transformers
M. SECTION 26 24 13 - Switchboards
N. SECTION 26 24 16 - Panelboards
O. SECTION 26 27 26 - Wiring Devices
P. SECTION 26 28 16 - Enclosed Switches and Circuit Breakers
Q. SECTION 26 29 23 - Variable Frequency Motor Controllers
R. SECTION 26 32 13 - Engine Generator Sets

S. SECTION 26 41 00 - Lightning Protection System
T. SECTION 26 43 13 - Surge Protective Devices
U. SECTION 26 50 00 - Lighting
V. SECTION 28 31 00 - Fire Alarm Systems
W. SECTION 40 70 00 - Instrumentation for Process Systems

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. ASTM International (ASTM):
   1. ASTM B3 - Soft or Annealed Copper Wire.
   2. ASTM B8 - Concentric Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   3. ASTM B33 - Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.
C. Institute of Electrical and Electronic Engineers (IEEE):
   1. IEEE 80 - Guide for Safety in Substation Grounding.
   2. IEEE 81 - Guide for Measuring Ground Resistance, and Potential Gradient in the Earth.
   3. IEEE 3003.1 - Recommended Practice for the System Grounding of Industrial and Commercial Power Systems.
   4. IEEE 3003.2 - Recommended Practice for Equipment Grounding and Bonding in Industrial and Commercial Power Systems.
D. National Electrical Contractors Association (NECA) Installation Standards.
E. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC)
F. Underwriters Laboratories (UL):
   1. UL 467 - Standard for Safety Grounding and Bonding Equipment.
   2. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   3. UL 869 - Electrical Service Equipment.
   4. UL 891 - Switchboards.

1.05 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Product Data: Submit manufacturer's data on all grounding and bonding components and associated accessories.
C. Qualification Data: For Qualified Testing Agency and testing agency's field Supervisor.
D. All field test reports.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C700-7.13.

1.07 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. Testing Agency Qualifications: Must be a member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
D. Comply with UL 467 for grounding and bonding materials and equipment.

1.08 QUALITY ASSURANCE:

A. As specified in EJCDC C700-7.13.

1.09 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide grounding and bonding products of one of the following (for each type of product):
    1. Grounding Products:
        a. Anderson Electrical Products, Hubbell Inc.
        b. Burndy LLC.
        c. Cadweld, Erico, nVent Electric, plc.
        d. Crouse-Hinds, Eaton.
        e. Erico, nVent Electric, plc.
        f. Copperweld Bimetallics, LLC.
        g. Harger Lightning and Grounding.
        h. Ideal Industries, Inc.
        i. Joslyn, MacLean Power Systems.
        j. Myers, Crouse-Hinds, Eaton.
        k. O-Z/Gedney, Emerson Electric Company.
        l. Preferred Lightning Protection, Inc.
        m. Thomas & Betts, ABB Group.
        n. Engineer-approved equal.

2.02 GROUNDING AND BONDING:

A. Materials and Components:
    1. General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Contractor's code-compliance option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications.
    2. Conductors: as specified in SECTION 26 05 19.
        a. For buried and exposed grounding conductors as specified for Grounding Conductors.
        b. Bonding conductors shall be the same as specified for Power Cables.
        c. Equipment grounding conductors shall be as specified on the Drawings.
        d. Refer to Material Designation Table on Drawings for areas requiring tinned ground conductors.
    3. Separately derived systems: Ground each separately derived system as required by the NEC Article 250.

4. Service Surge Protection: Refer to SECTION 26 43 13. Ground according to manufacturer's installation requirements and recommendations.
5. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600V. Lexan or PVC, impulse tested at 5,000V.
6. Bonding Plates, Connectors, Terminals, and Clamps: Provide electrical bonding plates, connectors, terminals, lugs, and clamps as recommended by bonding plate, connector, terminal, and clamp manufacturers for indicated applications.
    a. Bolted Connectors for Conductors and Pipes: Copper or copper-alloy, pressure type with at least two silicon bronze or stainless-steel bolts and lock washers.
    b. Bolted Service Connectors for Structural Steel: Shall have high-conductivity bronze alloy bolts and corrosion-resistant copper alloy nuts.
    c. Irreversible Compression Fittings: Pure wrought copper extrusion clamps and connectors, made to be held in the dies of an installation tool. Connectors must be factory filled with an oxide inhibitor.
    d. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
    e. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals and long-barrel, two-bolt connection to ground bus bar.
7. Ground Rods or Ground Electrodes:
    a. Ground Rods or Grounding Electrodes: Copper-clad steel or copper-alloy, sectional type rods. One end pointed to facilitate driving, 3/4-inch diameter by 10 feet.
8. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service required or indicated.
9. Mastic Coatings:
    a. Sonneborn-Sonoshield Mastics (BASF Construction Chemicals LLC).
    b. W.R. Meadows - Sealmastic.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standards of Installation," and in accordance with recognized industry practices to ensure that products comply with requirements.

B. A grounding electrode shall be installed at each building or structure as indicated.
    1. Grounding electrodes shall consist of the following:
        a. Ground rod and cable system.
        b. Concrete-encased electrode.
        c. Grounded metal frame of the building or structure.
        d. Metal underground water pipe.
        e. Other systems or structures as indicated.

C. Ground Rods:
    1. Install rods as indicated by driving and not by drilling or jetting.
    2. Drive rods into unexcavated portion of the earth where possible.

3. Where rods must be installed in excavated areas, drive rods into earth after compaction of backfill is completed.
4. Drive to a depth such that top of rods will be approximately 18 inches below final grade or subgrade, and connect main grid ground cable thereto.
5. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
6. Separation between ground rods shall be equal to or greater than the length of the rods.
7. The ground electrode conductor shall not contain splices between the ground electrode and the service entrance equipment.
8. For grounding electrode systems, where the grounding system shown on the plans do not meet the ground resistance requirement, install additional rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Counterpoise Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column indicated, indicated item, extending around the perimeter of building or structure indicated.
   1. Install a ground conductor for the ground ring and for taps to building steel.
   2. Bury ground ring not less than 24 inches (600 mm) from building or structure foundation.

E. Test Wells: Test well handholes shall be at least 12 inches (300 mm) deep, with cover.
   1. Ground rod driven through drilled hole in bottom of handhole.
   2. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance.
   3. Set top of test well flush with finished floor, or for exterior locations no more than 1” above finished grade.

F. Grounding Conductors:
   1. Install conductors meeting Specification 26 05 19 Low Voltage Conductors and Cables.
   2. Install using as few joints as possible. Route along shortest and straightest paths possible unless otherwise indicated or required by Code.
   3. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Suitably protect cable against damage during construction.
   4. Replace or suitably repair cable if damaged by anyone before final acceptance.
   5. In Exposed Installations:
      a. Route runs as indicated.
      b. Route along the webs of columns and beams, and in corners where possible for maximum physical protection.
      c. Where physical protection is required, install in PVC conduit unless indicated otherwise.
      d. Support at intervals of 3 feet or less with nonmagnetic clamp-type supports.
   6. In Buried Installations:
      a. Conductor sizes shall be as indicated for specific connections. For required connections not indicated, use conductor size not less than #4/0 AWG if buried in the earth or cast in concrete, or # 6 AWG at other locations.
      b. Lay in bottom of trench or in other excavations at the depth of the top of the ground rod.
      c. Bury at least 30 inches (600 mm) below grade.
      d. Maintain clearance of at least 12 inches from all underground metal piping or structures, except where connections thereto are specifically indicated.

e. Ground cable shall enter the bottom of electrical gear or panels sitting on a slab through a PVC sleeve.

7. Backfill as specified in DIVISION 2.
8. Duct-Bank Grounding Conductor: Embed within duct bank when indicated as part of duct-bank installation. Tie embedded grounding cable to reinforcing steel at intervals not exceeding 20-feet.

G. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

H. Ground Bonding Common with Lightning Protection System: Where a lightning protection system is present, comply with NFPA 780 and UL 96A when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.

I. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors or irreversible compression fittings with appropriate anti-corrosion agent for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

J. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors with silicon bronze or stainless-steel bolts and lock washers.
2. Use exothermic-welded connectors or irreversible compression fittings with appropriate anti-corrosion agent where grounding conductors connect to underground grounding conductors and underground grounding electrodes.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel:
a. Exothermically welded connectors, where allowed by the Structural Engineer.
b. Bolted fittings where structural steel cannot be welded but can be field drilled.
c. Irreversible compression ground clamp with breakaway bolt head to building steel that cannot be altered.
5. Clean metal contact surfaces of clamp-on connectors to ensure electrical conductivity and circuit integrity.
6. Exothermic terminations:
a. Conform to manufacturer's instructions.
b. Chemically degrease and dry completely before welding.
c. Apply one coat of mastic coating to all exothermic-welded connections to be buried.

K. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than #3/0 AWG for a grounding conductor.
1. If the concrete foundation is less than 20 feet (6 m) long, route conductor along another direction, doubling back on opposite side, if necessary.

2. Bond grounding conductor to reinforcing steel matte in at least four locations using compression fittings designed for the intended purpose.
3. The grounding connection to the supplemental electrode shall be bonded by either exothermic welding or irreversible compression fittings.
4. Extend a bonding conductor from concrete-encased electrode, below grade and out to building's grounding grid and bond.
5. Extend a bonding conductor from at least one concrete-encased electrode out of the concrete and bond to the grounding electrode.
6. Welding Ufer grounding conductor directly to the structural steel is prohibited, unless approved by the Structural Engineer, in which case adhere to the following:
    a. A pig-tail of copper from the concrete-encased electrode shall penetrate the foundation and be exothermically welded to the structural steel.

L. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 18 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.
3. Insulate and support grounding bus at intervals not to exceed 2 feet on centers or as indicated.

M. Grounding and Bonding of Metal Underground Water Pipe:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes. Use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Gas Piping: If installed in, or attached to, a building or structure, bond each aboveground portion of gas piping system downstream from equipment shutoff valve. Metal underground gas piping systems shall NOT be used as a grounding electrode.
4. Metal Process Water Pipes:
    a. For a small or medium-sized pipe, connect the pipe to the ground system at an exposed location using a mechanical bolted clamp connector with silicon bronze hardware.
    b. Follow manufacturer’s instructions for cleaning pipe and applying oxide inhibiting compound around perimeter of connector.

N. Grounding at Handholes:
1. Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished/gravel floor.
2. If necessary, install ground rod before manhole is placed and provide #1/0 AWG minimum bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall.
3. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete.
4. Seal floor opening with waterproof, non-shrink grout.

O. All grounding system components shall be bonded to form one continuous grounding electrode.
P. Ground electrical service system neutral at service entrance equipment to grounding electrodes.
Q. Ground each separately derived system neutral to the main building ground system.
R. Bond the system neutral to service entrance equipment enclosures.
S. Ground all exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductors in raceways and cables, receptacle ground conductors, and metallic plumbing systems.
T. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.
U. Apply mastic coating to field connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.

3.02 INSTALLATION - EQUIPMENT GROUNDING:

A. Install insulated equipment grounding conductors with all feeders and branch circuits.
B. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug on substation, switchgear, switchboard, motor control center, or panelboard ground bus. When conduit enters from below and is not connected to the enclosure, ground equipment grounding conductor on conduit grounding bushing and then bond to ground bus (or grounded enclosure if there is no ground bus).
C. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
    1. Feeders and branch circuits.
    2. Lighting circuits.
    3. Receptacle circuits.
    4. Single-phase motor and appliance branch circuits.
    5. Three-phase motor and appliance branch circuits.
    6. Flexible raceway and power cords runs.
    7. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
    8. Computer and Rack-Mounted Electronic Equipment circuits.
D. Ground wireway at least once and at 10-foot intervals.
E. Ground all continuous runs of metallic cable tray and all isolated sections of metallic cable tray at each end. Install NEC sized bare copper equipment ground conductor in all cable tray. Clamp equipment ground conductor to cable tray at 20-foot intervals.
F. Bond cable trays routed parallel to each other with an NEC sized, bare copper tray bonding jumper ground conductor (based on highest ampacity circuit) at 100 foot intervals.
G. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than #2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.
H. Bonding Interior Metal Ducts: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120V and more, including air cleaners, heaters,

blowers, fans, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping. Install tinned copper bonding jumper to bond across flexible duct connections to achieve continuity.

I. Water Heater and Heat-Tracing Cables: Install separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

J. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J STD-607-A.
   1. For telephone, alarm, voice and data, and other communication equipment, provide #4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
   2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4- by 4- by 12-inch (6.3- by 100- by 300-mm) grounding bus.
   3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

K. Ground fence enclosures at each post with Burndy Type GK and GAR connectors. Install flexible braid straps across all hinge points and gates for fence enclosures. Bond fence posts, gates, and fence material to ground where crossed above by a utility line.

L. Supplementally bond all motors and equipment 50 Hp or larger to the grounding electrode system with a minimum #6 AWG bare copper wire.

M. Bond all motors with “identified” equipment grounding conductor. Route in conduit with phase conductors.

N. Enclosure Grounds: Bond all enclosures by direct copper connection to the grounding electrode system.

O. Building Grounding Conductors: Support at intervals not to exceed 3 feet on center or as indicated.

3.03 LABELING:

A. Comply with requirements in SECTION 26 05 53 - Identification for Electrical Systems for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor, grounding equalizer, and at the grounding electrode conductor where exposed.
   1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.04 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Tests and Inspections:
   1. Perform tests per SECTION 26 08 10.
   2. Do not cover up connections before they are inspected by Engineer.
   3. Compression-type connections shall be inspected for embossment of proper die index per manufacturer’s instructions.
   4. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

5. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
6. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.
   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81 for the following:
      (1) Testing and commissioning of new grounds, not yet connected to the utility power supply.
      (2) Testing complex ground systems that include a metallic loop.
   c. A clamp-on ground tester may only be used if the Owner does not require strict adherence to IEEE 81 and for the following situations:
      (1) To test installed grounds without disconnecting them from the utility.
      (2) To test a grounding electrode configuration where the return path includes the earth. (This does not include a ground system that includes a metallic loop.)
      (3) To test the resistance of a single rod in a series or array.
      (4) To check errant current flow to ground for operator safety.
7. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Prepare test and inspection reports.

F. Maximum grounding values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 Ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1,000 kVA: 5 Ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1,000 kVA: 3 Ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 Ohms.
5. Substations and Pad-Mounted Equipment serving equipment less than 1,000 kVA: 5 Ohms.
6. Substations and Pad-Mounted Equipment serving equipment greater than 1,000 kVA: 3 Ohms.
7. Manhole Grounds: 10 Ohms.

G. Grounding system will be considered defective if any maximum grounding values are exceeded. Provide additional grounding, and grounding rods as necessary so that no maximum grounding value is exceeded.

3.05 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION specifies hangers, supports, anchors, sleeves, and seals for electrical equipment and systems as well as construction requirements for concrete bases as indicated by Drawings and schedules and/or specified in other Sections in DIVISION 26.
B. Types of hangers, supports, anchors, sleeves, and seals specified in this SECTION include the following:
   1. Clevis hangers.
   2. Riser clamps.
   3. Steel rod coupling.
   4. C-clamps.
   5. I-beam clamps.
   6. One-hole conduit straps.
   7. Two-hole conduit straps.
   8. Hexagonal nuts.
   9. Round threaded steel rods.
   10. Conduit clamps.
   11. U-bolts.
   12. Lead expansion anchors.
   13. Toggle bolts.
   14. Wall, ceiling, roof and floor seals.
   15. Conduit cable supports.
   16. U-channel strut system.
   17. Fire and smoke stop compounds.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. DIVISION 3 – Concrete.
B. SECTION 26 00 00 - General Electrical Requirements
C. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems
D. SECTION 26 05 33 – Raceways, Boxes, Seals, and Fittings for Electrical Systems

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. ASTM International (ASTM):
   1. ASTM-A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   2. ASTM-E814 REV A - Standard Test Method for Fire Tests of Penetration Firestop Systems, pertaining to fire stop components.
C. American Welding Society (AWS):
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

D. National Fire Protection Association (NFPA):
   1. NFPA-70 - National Electrical Code (NEC).
E. National Electrical Contractors Association (NECA):
   1. NECA 1 – Standard Practice of Good Workmanship In Electrical Construction.
F. Society of Protective Coatings (SSPC):
   1. SSPC-PA 1 - Shop, Field and Maintenance Painting of Steel.
G. Underwriters Laboratories (UL):
   1. Provide electrical devices, components, and fire stops which are UL-listed and labeled.

1.05 PERFORMANCE/DESIGN CRITERIA:

A. Delegated Design:
   1. Design supports for multiple raceways including seismic bracing, where required, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated. Raceways to be capable of supporting combined weight of supported systems and their contents.
   2. Design for seismic anchoring, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   3. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
   4. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.
B. Materials and Designation: Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.
C. Seismic Performance: Equipment shall withstand the effects of earthquake motions. Refer to Structural design.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces or short circuit current specified and the unit will be fully operational after the seismic event."

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Product Data:
   1. Submit manufacture's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve, and seal.
C. Shop Drawings:
   1. Submit dimensioned drawings of fabricated products, indicating weights, strength, details of fabrication, and details of materials.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C700-7.13.

1.08 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
C. Comply with NEC.

1.09 COORDINATION:

A. Coordinate size and location of supports. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete specifications.
B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.10 WARRANTY

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Anchor Manufacturers: Subject to compliance with requirements, provide anchors of one of the following manufacturers.
   1. Hilti, Inc.
   2. Ideal Industries, Inc.
   3. Joslyn Manufacturing Co., Inc.
   4. Eaton/Cooper; McGraw Edison Co.
   5. Unistrut; Atkore International.
B. Channel System Manufacturers: Subject to compliance with requirements, provide channel system of one of the following manufacturers.
   1. Allied Tube & Conduit Corp.
   2. Eaton/Cooper; B-Line Systems, Industries.
   3. Erico International Corp.
   4. Kindorf; Thomas & Betts Corp.
   5. Power-Strut; Power Engineering Co.
   6. Unistrut; Atkore International.
C. Fire and Smoke Stop Compounds: Subject to compliance with requirements, provide channel system of one of the following manufacturers.
   1. 3M Company.
   2. Hilti, Inc.

2.02 STEEL SUPPORT SYSTEMS:

A. General: Provide supporting devices which comply with manufacturer's standard materials, design, and construction in accordance with published product information, as required for complete installation, and as herein specified. All supports shall be designed for the support of the maximum number of conduits and their maximum conductor weights for maximum conduit loading. Where more than one type of supporting device meets indicated requirements, selection is Contractor's option. Do not use perforated metal straps for supports.
B. Provide as required to rigidly support all conduit runs, boxes, and equipment.
C. Support conduit within 12 inches of enclosures to which conduits are attached.

D. Do not exceed the manufacturers recommended distance between supports on horizontal or vertical runs.

E. Supports: Supporting devices of types, sizes, and materials indicated, and having the following construction features. Refer to Specification 26 00 00 for material requirements.
   1. Clevis Conduit Hangers: For supporting conduit;3/8-, 1/2-, 5/8- or 3/4-inch rod, size of clevis and rod as required.
   2. Riser Clamps: For supporting conduit, with two bolts and nuts.
   3. Steel Rod Couplings: Provide 3/8-, 1/2-, 5/8- or 3/4-inch straight rod couplings, size as required.
   4. C-Beam Clamps: 3/8-, 1/2-, 5/8-, or 3/4-inch rod, size as required.
   5. I-Beam Clamps: 3/8, 1/2-, 5/8-, or 3/4-inch rod, size as required; 3/8-inch horizontal "J" hook safety rod that bolts across the flange, flange width as required.
   6. One-Hole Conduit Straps: For supporting conduit; size as required.
   7. Two-Hole Conduit Straps: For supporting conduit, size as required.
   8. Hexagonal Nuts, Flat Washers and Lock Washers: For 3/8-, 1/2-, 5/8-, or 3/4-inch rod, size as required.
   9. Round Threaded Steel Rod: 3/8-, 1/2-, 5/8-, or 3/4-inch diameter, size as required. Minimum size is 3/8-inch diameter.
   10. Conduit Clamps: For supporting conduit; size as required.
   11. U-Bolts: For supporting conduit; size as required.

F. Fabricated supports:
   1. From structural steel or manufactured framing members equal to "Unistrut" P1000 (1-5/8 inch by 1-5/8 inch) series as manufactured by Unistrut Corporation, Kindorf B-995 (1-1/2 inch by 1-1/2 inch) series as manufactured by Thomas and Betts, or Superstrut A-1200 (1-5/8 inch by 1-5/8 inch) series as manufactured by Thomas and Betts.
   2. Minimum 12 gauge.

G. Coated Supports:
   1. Channel shall be coated using an electro-deposition process with an epoxy or acrylic coating.
   2. Unscribed samples shall exceed 600-hour salt spray when tested in accordance with ASTM B117.
   3. Provide conduit clamps and hangers finished with the same process as the support and sized for the specific conduit size.
   4. Provide zinc-plated anchors, inserts, bolts, washers, nuts, and support hardware.

H. Hot-Dipped Galvanized Supports:
   1. Channel shall be hot-dipped galvanized after all manufacturing operations are complete.
   2. Channel shall have a minimum of 2.5 mils or 1.5 ounces of coating per square foot on each side of the steel and conform to ASTM A123 and ASTM A153.
   3. Provide conduit clamps and hangers finished with same process as the support and sized for the specific conduit size.
   4. Provide stainless-steel rods, anchors, inserts, bolts, washers, nuts with all other support hardware hot-dipped galvanized.

I. Stainless-Steel Supports:
   1. Channel Type 304 stainless steel conforming to ASTM A240.
   2. Stainless-steel conduit clamps and hangers, sized for the specific conduit diameter.
   3. Provide stainless-steel rods, anchors, inserts, bolts, washers, nuts, and support hardware.

J. Anchors: Anchors of types, sizes and materials indicated, with the following construction features.
   1. Lead Expansion Anchors: 1/2, 5/8, or 3/4 inch as required.

2. Toggle Bolts: Springhead, 3/16 by 4 inch or larger size as required.

K. Conduit Cable Supports: Cable supports with insulating wedging plug for nonarmored type electrical cables in risers; construct for rigid metal conduit (size as required) number of wires as required, type wire as specified; construct body of malleable-iron casting with hot-dip galvanized finish.

L. U-Channel Strut Systems: Unless indicated otherwise, U-channel strut system for supporting electrical equipment, 12-gauge steel hot-dip galvanized after fabrication for wet and outdoor locations, 12-gauge standard green paint finish for dry and indoor locations, of types and sizes indicated; construct with 9/16-inch diameter holes, 8 inch o.c. on top surface, and with the fittings as required which mate and match with U-channel.

M. Fire and Smoke Stop Compounds: Provide one of the following:
1. 3M Fire Barrier 2000+.
2. Hilti, Inc. FS-ONE MAX.

PART 3 - EXECUTION

3.01 ERECTION, INSTALLATION, APPLICATION:

A. All conduits in pump rooms to be fed from below grade to avoid bridge crane operation.

B. Install hangers, anchors, sleeves, and seals as specified, required, indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NFPA 70 for installation of supporting devices.

C. Install hangers, supports, clamps, and attachments to support conduit properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacing indicated and as required by NFPA 70 or as indicated when less than NFPA 70 required spacing.

D. Torque sleeve seal nuts, complying with manufacturer's recommended values. Ensure that sealing grommets expand to form watertight seal.

E. Design trapeze type supports, including fasteners to the structure to carry the following loads:
1. Outdoor supports shall have the following added to the calculated load:
   a. Ice weighing 57 pounds per cubic foot to a thickness of 0.25 inches over the projected area of the supports and conduit being supported.
   b. Snow weighing 8 pounds per square foot over the projected area of the conduit being supported.
   c. Wind at 25 pounds per square foot acting in a downward direction.
2. The greater of the following:
   a. The total calculated load multiplied by a factor of 4.
   b. The total calculated load +200 pounds.

F. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

G. Repair damage to painted finishes with paint recommended by manufacturer.

H. Install fire and smoke stop compounds at all penetrations of fire rated walls, floors, ceilings and roofs. Install fire and smoke stop compounds in accordance with manufacturer's instructions to provide a fire seal rating equal to or greater than that of the surface penetrated.
1. Testing shall be performed in accordance with ASTM-E814 REV A and applicable local codes.

I. Provide seismic support and bracing for all multiple conduit support trapezes plus individually supported conduit 2-1/2 inches and larger such that the supports shall resist the forces of a Seismic Factors event without collapse.

J. Provide seismic support and bracing for all busway and cable tray such that the support shall resist the forces of Seismic Factors event without collapse.

3.02 CONCRETE BASES:

A. Construct concrete bases of dimensions indicated but not less than 3.5 inches (100 mm) larger in both directions than supported unit, unless larger dimensions are required by the equipment manufacturer or delegated seismic design, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in DIVISION 3 – Concrete.
C. Anchor equipment to concrete base.
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.03 SUPPORTS:

A. Construct with sufficient rigidity to hold all mounted equipment and material in permanent and neat alignment.
B. Design to provide ¼-inch space between equipment housings and walls or columns upon which they are mounted.
C. Do not exceed load requirements in NEC and NEMA standards.
D. Provide individual conduit hangers for supporting individual conduits.
E. Provide trapeze hangers to support multiple conduit runs. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and an additional 90 kg (200 lbs). Attach each conduit with U bolts or other approved fasteners.
F. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T bars, angle supports, and similar items.
G. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.
H. For galvanized members after Power Tool Cleaning SSPC-SP11, paint all welds, field cuts, and damaged areas with organic zinc-rich primer at 3-mils dry film thickness.
   1. Ameron – 68HS.
   2. Carboline – Carbozinc 859.
   3. International – Interzinc 52 HS.
   4. Tnemec – Tnemezinc 90-97.
I. For coated supports, paint all welds, field cuts, and damaged areas with manufacturer's recommended paint.
J. The following conduit types are to use support types as listed below. Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.
   1. Use hot-dipped galvanized supports, clamps, and straps, and stainless-steel hardware to support steel conduit.
   2. Use stainless-steel or PVC-coated conduit straps to support PVC-coated rigid steel conduit. Use stainless-steel clamps for supporting PVC coated rigid steel conduit on stainless-steel supports.

3. Use stainless steel conduit clamps and hardware to support nonmagnetic conduit.

3.04 PAINTING:

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint with a brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Clean and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal as required.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.05 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 05 29

SECTION 26 05 33 – RACEWAYS, BOXES, SEALS, AND FITTINGS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION specifies raceway Work for this Contract.
B. Provide raceway and material including:
   1. Conduit.
   2. Outlet and device boxes.
   3. Pull and junction boxes.
   4. Fittings.
   5. Bushings and ground bushings.
   6. Locknuts.
   7. Knockout closures.
   8. Grout.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. DIVISION 2 – Sitework
B. SECTION 26 00 00 - General Electrical Requirements
C. SECTION 26 05 19 - Low Voltage Conductors and Cables
D. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems
E. SECTION 26 05 29 - Hangers and Supports for Electrical Systems
F. SECTION 26 05 44 - Sleeves and Sleeve Seals for Electrical Raceways and Cabling
G. SECTION 26 05 53 - Identification for Electrical Systems

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of the Issued For Construction (IFC) date of the Contract Documents unless otherwise indicated.
B. American National Standards Institute (ANSI):
   1. ANSI C80.1 - Electrical Rigid Steel Conduit (ERSC).
C. American Welding Society (AWS):
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel.
D. ASTM International (ASTM):
   1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   2. ASTM A153/A153M. - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   3. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   4. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   5. ASTM B117 -Standard Practice for Operating Salt Spray (Fog) Apparatus.

6. ASTM C1107/C1107M REV A - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
7. ASTM D3917 REV A - Standard Specification for Dimensional Tolerance of Thermosetting Glass-Reinforced Plastic Pultruded Shapes.
8. ASTM D4385 - Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products.
9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
10. ASTM F2160 - Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD).

E. Joint Industrial Council (J.I.C.):
1. Comply with standards for Oil and Dust Tight Lay-In Wireway.

F. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code (NEC).

G. National Electrical Contractor's Association (NECA):
1. NECA NEIS 1 - Standard for Good Workmanship in Electrical Construction.

H. National Electrical Manufacturers Association (NEMA):
1. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
2. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit.
3. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
4. NEMA TC 6 and 8 - Polyvinyl Chloride (PVC) Plastic Utilities for Underground Installation.
5. NEMA TC 14.AG - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
6. NEMA TC 14.BG - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
7. NEMA TC 14.XW - Extra Heavy Wall Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
8. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
9. NEMA OS 2 - Nonmetallic Outlet Boxes, Covers, and Box Supports.
10. NEMA 250 - Enclosures for Electrical Equipment (1,000V Maximum).

I. Society of Protective Coatings (SSPC):
1. SSPC-PA 1 - Shop, Field and Maintenance Painting of Steel.
2. SSPC-SP3 - Power Tool Cleaning.

J. Underwriters' Laboratories, Inc. (UL):
1. Provide all devices, components, and equipment that are UL listed and labeled.
2. UL 1 - UL Standard for Safety Flexible Metal Conduit.
3. UL 5 - UL Standard for Safety Surface Metal Raceways and Fittings.
4. UL 5C - UL Standard for Safety Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits.
5. UL 6 - UL Standard for Safety Electrical Rigid Metal Conduit – Steel.
6. UL 50 - UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations.
7. UL 50E - UL Standard for Safety Enclosures for Electrical Equipment, Environmental Considerations.
8. UL 360 - UL Standard for Safety Liquid-Tight Flexible Metal Conduit.

9. UL 514A - UL Standard for Safety Metallic Outlet Boxes.
10. UL 514B - UL Standard for Safety Conduit, Tubing, and Cable Fittings.
11. UL 514C - UL Standard for Safety Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
12. UL 651 - UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
13. UL 651A - UL Standard for Safety Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit.
14. UL 1203 - UL Standard for Safety Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
15. UL 2515 - UL Standard for Safety Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.05 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Product Data:
   1. Submit manufacturer's technical product data, including conduit ratings, specifications, recommended installation applications (i.e. horizontal bore, direct bury, open trench) and installation instructions, for each type of product required. Include data substantiating that materials comply with the Contract Documents.
   2. Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve, and seal.
C. Certifications:
   1. Submit certifications for personnel responsible for installing conduit and fittings with PVC coated jackets.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

1.07 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, Structural Welding Code - Steel.
C. Comply with NEC.
D. Installations shall follow the standard practices of NECA NEIS 1.
E. Installers of the PVC-coated galvanized rigid conduit system shall be certified by the manufacturer and be able to present a valid, unexpired certified installer card prior to starting installation. All clamping, cutting, threading, bending, and assembly instructions given during the manufacturer’s certified installation training shall be followed.

1.08 PERFORMANCE/DESIGN CRITERIA:

A. Materials and Designation: Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.

1.09 WARRANTY

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Rigid Galvanized-Steel Conduit (RGS):
   1. Allied Tube and Conduit, Atkore International.
   2. Western Tube and Conduit Corporation.
   3. Wheatland Tube Company, JMC Steel Group.
   4. Republic Conduit, Tenaris.
B. Fittings for Rigid Steel Conduit:
   1. Heavy-Duty Cast Malleable Iron Fittings:
      a. Appleton, Emerson Electric Company.
      b. Crouse-Hinds, Eaton.
      c. Thomas & Betts, ABB Group.
   2. Conduit Expansion and Deflection Fittings:
      a. O-Z/Gedney, Emerson Electric Company.
      b. Thomas & Betts, ABB Group.
      c. Engnineer Approved Equal.
C. Rigid Steel Conduit and Fittings with Bonded Polyvinyl Chloride (PVC) Jacket:
   1. OCAL, Thomas & Betts, ABB Group.
   2. Robroy Industries.
   3. Engnineer Approved Equal.
D. Rigid Polyvinyl Chloride (PVC) Conduit and Fittings:
   1. IPEX Inc.
   2. North American Specialty Products.
   3. Carlon, Thomas & Betts, ABB Group.
   4. Cantex Inc.
E. Liquid-Tight Flexible Metal Conduit:
   1. AFC Cable Systems, Atkore International.
   2. Anamet Electrical, Inc.
   3. Electri-Flex Company.
   4. Southwire Company, LLC.
   5. Thomas & Betts, ABB Group.
F. Outlet and Device Boxes:
   1. Appleton, Emerson Electric Company.
   2. Crouse-Hinds, Eaton.
   3. Killark, Division of Hubbell, Inc.
   4. Leviton Manufacturing Company, Inc.
   5. O-Z/Gedney, Emerson Electric Company.
   6. Thomas & Betts, ABB Group.
G. Pull and Junction Boxes:
   1. Metallic Indoor and Outdoor Boxes:
      a. B-Line, Eaton.

b. Hoffman, nVent Electric, plc.
c. Wiegmann, Hubbell Inc.

H. Conduit Hubs and Bodies:
1. Appleton, Emerson Electric Company.
2. Myers Industries, Inc. (ITT).
3. Crouse-Hinds, Eaton.
4. O-Z/Gedney, Emerson Electric Company.
5. Thomas & Betts, ABB Group.

I. Fittings:
1. Crouse-Hinds, Eaton.
2. Appleton, Emerson Electric Company.
3. Thomas & Betts, ABB Group.

J. Bushings, Grounding Bushings, and Locknuts:
1. Arrow Hart, Eaton.
2. Appleton, Emerson Electric Company.
3. O-Z/Gedney, Emerson Electric Company.
4. Raco, Hubbell, Inc.
5. Steel City, Thomas & Betts, ABB Group.

K. Electrical Enclosures:
1. Hoffman, nVent Electric, plc.
2. Saginaw Control and Engineering.
3. Wiegmann, Hubbell, Inc.

L. Anchor Manufacturers: Subject to compliance with requirements, provide anchors of one of the following manufacturers.
1. Hilti, Inc.
2. B-line, Eaton.
3. Powers, DeWalt.
4. Red Head, ITW.
5. Unistrut, Atkore International.

M. Metal Channel System Manufacturers: Subject to compliance with requirements, provide channel system of one of the following manufacturers.
1. B-line, Eaton
2. Erico, nVent Electric, plc.
3. Kindorf, Thomas & Betts, ABB Group.
4. Power-Strut, Atkore International.
5. Superstrut, Thomas & Betts, ABB Group.
6. Unistrut, Atkore International.

2.02 DESIGN REQUIREMENTS:

A. Conduit:
1. Each length of threaded conduit furnished with coupling on one end and metal or plastic thread protector on other end.
2. Provide UL listed and labeled conduit, on each length, fittings, and accessories.
3. Sizes of conduit, fittings, and accessories as indicated, specified, or as required by Electrical Codes and Standards.

B. Supports: refer to SECTION 26 05 29.

2.03 RIGID GALVANIZED STEEL CONDUIT:

A. Raceway:
   1. For Materials and Designation: Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.
   2. Conform to ANSI C80.1, and UL 6.
   3. Mild ductile steel, circular in cross section with uniform wall thickness sufficiently accurate to cut clean threads.
   4. Each length threaded on both ends with threads protected.
   5. All scale, grease, dirt, burrs, and other foreign matter removed from inside and outside prior to application of coating materials.
   6. Galvanized by the hot-dip process as follows:
      a. Interior and exterior surfaces coated with a solid, unbroken layer of 99% virgin zinc by dipping.
      b. Coating not to show fixed deposits of copper after four 1-minute immersions in a standard copper sulfate solution.
      c. One coat of zinc-chromate finish on inside and outside surfaces to prevent oxidation and white rust.
   7. Couplings and elbows fabricated, coated and finished by the same process as conduit.

B. Fittings:
   1. Heavy-Duty Cast Malleable Iron Fittings:
      a. For changes in direction on conduits 2" and larger, install pull boxes, rather than fittings.
      b. Full-threaded hubs and rubber-gasketed covers.
      c. Zinc, cadmium-plated, or bronze hardware bolts and screws for assembly.
      d. Finished with cadmium plating or galvanizing.
      e. Form 8 bodies and covers.
      f. Standard and junction fittings.
   2. Conduit Expansion Fittings:
      a. Line of Conduit Type:
         (1) Galvanized expansion fittings for rigid conduit movement up to 4 inches.
         (2) Insulated metal bushing on ends of the conduit, bonding jumper, and with expansion head sealed with a high-grade graphite packing.
         (3) O-Z/Gedney, Type AX with Type AJ bonding jumper or Thomas & Betts, Type XJG, or Engnineer Approved Equal.
      b. End Type:
         (1) For conduit terminating in a junction box.
         (2) O-Z/Gedney, Type EXE with Type BJ-E bonding jumper, Engnineer Approved Equal.
   3. Conduit Expansion and Deflection Fittings:
      a. Provide for movement of 3/4 inch from normal in all directions between two rigid conduits.
      b. Integral bonding jumper.
      c. O-Z/Gedney, Type DX., or Engnineer Approved Equal.
   4. Conform to NEMA Type 1 enclosure in all nonhazardous areas except as specified or indicated otherwise.
   5.

2.04 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT:

A. Fabricated from self-extinguishing high-impact polyvinyl chloride designed for aboveground and underground installations.
B. Shall meet NEMA TC2, TC6 and TC8, and UL 651.
C. Type EPC Schedule 80 heavy-wall rigid conduit.
D. Fittings and accessories fabricated from same material as conduit. Shall meet NEMA TC3.
E. Solvent-cement-type joints as recommended by manufacturer.

2.05 LIQUID-TIGHT FLEXIBLE METAL CONDUIT:

A. Liquid-tight conduit with flexible galvanized-steel core and a synthetic rubber, polyvinyl chloride, or thermoplastic covering.
B. Shall comply with UL 360.
C. Spiral encased copper bonding conductors for conduit in sizes 1-1/4 inches and smaller.
D. External grounding jumper as required.
E. Provide hot-dipped galvanized fittings for connections to rigid steel.
F. Fittings for liquid-tight flexible metal conduit shall comply with UL 514B.
G. Polyvinyl chloride (PVC) jacket, "Hi-Temp Liquatite Type H.T. ElectriFlex" where installed in a low or high temperature area, -40ºF, or high 220ºF, as specified or indicated.
H. Polyvinyl chloride (PVC) jacket, Type HA or Type O.R. "Seal-Tite" for oil-resistant applications.

2.06 OUTLET AND DEVICE BOXES:

A. Surface Mounted:
   1. Cast hub device boxes for receptacles and switches.
   2. Cast aluminum. Metallic boxes shall meet UL 514A and NEMA OS 1.
   3. PVC boxes for PVC conduit. PVC boxes shall meet UL 514C and NEMA OS 2.
   4. FS or FD single or multiple gang boxes as required.
   5. Outlet boxes intended for use in classified areas shall be UL 886 listed.
B. Flush Mounted in Plaster Walls:
   1. Galvanized, flat-rolled, sheet-steel non-gangable device boxes.
   2. Conduit knockout openings in bottom and sides.
   3. Threaded screw holes for fastening devices and box covers.
   4. Corrosion-resistant screws for equipment grounding.
   5. Include mounting brackets, device extensions plaster ears, and plaster board expandable grip fasteners (for existing plaster walls) compatible with box.
   6. Shall meet UL 514A and NEMA OS 1.

2.07 PULL AND JUNCTION BOXES:

A. Steel Boxes - Indoors:
   1. Hot-dipped galvanized steel.
   2. Galvanized-steel covers.
   3. Cadmium-plated or bronze screws and bolts.
   4. For special boxes where it is not possible to provide hot-dip galvanizing, apply organic zinc-rich primer at 3-mils dry film thickness after SSPC-SP3 Power Tool Cleaning.
   5. Minimum gauge requirements:

No surface No single

area exceeds	dimension exceeds	Gage steel
1,000 sq. inches	40 inches	14
1,500 sq. inches	60 inches	12
over 1,500 sq. inches	over 60 inches	10

6. Minimum of 14-gauge steel.
7. Conform to NEMA Type 1 enclosure in all nonhazardous areas except as specified or indicated otherwise.
    a. Junction boxes may be standard type with knock outs except as indicated otherwise.
8. Include piano-hinged, gasketed cover and interior mounting panel where oil-tight J.I.C boxes are used for enclosing terminal blocks and control relays.
9. Waterproof hubs in areas subject to moisture.

B. Steel Boxes - Outdoor:
1. Type 304 or 316 stainless steel with stainless-steel cover and stainless-steel clamps and screws.
2. Minimum 16 gauge for boxes with no dimension exceeding 6 inches and minimum 14 gauge for all other boxes.
3. Continuously welded seams shall be ground for a smooth finish.
4. Seamless gasket for cover.
5. Conform to NEMA Type 4X.
6. Provide continuous hinge, gasketed cover, and interior mounting plate when used for enclosing terminal blocks and control relays.
7. Provide rigid weatherproof conduit hubs for all boxes.

C. Metallic Barriers:
1. Designed not to separate phases of a power circuit.
2. Provide as indicated for the isolation of power circuits from other type circuits

D. Bushings: Provide threaded, nylon-insulated metallic bushings. Provide steel bushings for conduit sizes 1-1/2 inches and smaller. Provide malleable iron bushings for conduit sizes 2 inches and larger.

E. Grounding Bushings: Provided where indicated, specified and required by NEC. Provide threaded, insulated, malleable iron bushing with lay-in screw clamp lug.

F. Locknuts: Provide steel locknuts for conduit sizes 2 inches and smaller. Provide malleable iron aluminum for conduit sizes 2.5 inches and larger. Locknut material shall match conduit type.

G. Sealing Hub: Provide watertight, threaded, insulated sealing hub connectors for all outdoor and indoor wet locations where conduit enters into enclosures. Sealing hub threaded lengths shall be adequate to allow installation of bushing.

H. Knockout Closures: Provide steel press-in knockout seals for all unused punched out knockouts 2 inches and smaller. Provide steel two-piece bolt on knockout seals for all unused punched out knockouts 2-1/2 inches and larger.

I. Fittings: Provide all threaded nipples, insulated short elbows, offset nipples, offset connectors, enlargers and reducers as required.

J. Hinged-Cover Enclosures:

1. Comply with UL 50 and NEMA 250, Type 12 for indoor, and Type 4X for outdoor.
2. Provide with continuous-hinge cover with flush latch unless otherwise indicated.
3. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel, or Stainless-Steel per area requirements.
4. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
5. Metal barriers to separate wiring of different systems and voltage.
6. Gasketed enclosures shall meet UL 50E.

2.08 SUPPORT SYSTEM:

A. Provide as Specified in SECTION 26 05 29.

2.09 WALL AND DUCT SEAL:

A. Provide as specified in SECTION 26 05 44 for sleeves, seal fittings, silicone sealants and duct seal.

2.10 GROUT:

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 5,000-psi (34.5-MPa), 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 GENERAL

A. Comply with manufacturer's published instructions.
B. Follow the applicable NECA NEIS articles for installation of all conduits.
C. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Prior to pouring concrete plug coupling until conduit is extended above floor to destination or a minimum of 2 ft above finished floor.
D. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
E. Cut conduit perpendicular to the length. Use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
F. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of duct raceway and fittings before making up joints. Follow compound manufacturer's published instructions.
G. Clean out all conduits before pulling wire.
H. Clean out all conduits immediately after concrete work is finished.
I. Install pull wires in empty duct raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground duct raceways designated as spare above grade alongside duct raceways in use.

3.02 RACEWAYS INSTALLATION:

A. General Requirements:

1. Location:
   a. Conduits routed through pump room to be installed below floor to avoid operation of bridge crane.
   b. When shown, install conduit as near as possible to the routing indicated.
   c. Shift locations as required to avoid interference with other equipment and piping being installed.
   d. Route raceway so stubs up are located according to the equipment submittals next to indicated equipment connections or motor terminal boxes.
   e. Where routing of conduit is not indicated, such as for lighting home run circuits and other systems requiring small conduit runs, route conduit as specified subject to approval by Engineer.
2. Install horizontal runs as high above floor as possible, and in no case lower than 7 feet above floor, walkway, or platform in passage area.
3. Run conduit parallel or perpendicular to walls, ceiling, beams, and columns unless indicated otherwise.
4. Follow manufacturer's recommendations for field bending of conduit or use conduit fittings provided by manufacturer.
5. Route to clear all doors, windows, access wells, and openings.
6. Group parallel runs in neatly aligned banks where possible with minimum of 1-inch clearance between exposed conduits and three conduits OD between concealed or encased conduits.
7. Do not install duct raceways or electrical items on "explosion-relief" walls or rotating equipment.
8. Do not install conduits within 2 inches of the bottom side of a metal deck roof.
9. Maintain 6-inch clearance between conduit and coverings on all hot lines; steam, hot water, and the like.
10. Do not use conduit in sizes smaller than 3/4 inch, except 1/2 inch may be used for connections to control devices and thermocouples where necessary.
11. Route the raceway through wall floor and ceiling penetrations, provide holes and sleeves as specified in SECTION 26 05 44.
12. Complete duct raceway installation before starting conductor installation.
13. Install no more than equivalent of three 90-degree bends in conduit run. Support within 12 inch of changes in direction.
14. Make bends in duct raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
15. Make connections to boxes, panels, and other equipment as follows:
   a. Indoor Dry Locations: Double locknuts, one inside and one outside.
   b. Outdoor and Damp Locations: Rigid weatherproof conduit hubs.
   c. Bushings:
      (1) Threaded malleable iron or steel.
      (2) Insulated with Bakelite, molded and bonded into the bushing.
      (3) Placed on end of conduit in addition to locknuts.
      (4) Install with integral grounding connector and conductor where all conduits pass through multiple concentric panel knockouts and where the conduit must be bonded to equipment it is not attached to.
16. Running threads will not be permitted.
17. Coat all field cut threads in galvanized conduit with cold galvanizing paint.

18. Comply with applicable requirements of NEC pertaining to installation of conduit systems.
19. Place drainage fittings or weep holes at unavoidable low points where moisture can collect.
20. Install an entire conduit system that is electrically continuous with bonding jumpers provided as necessary to conform to NEC.
21. Install expansion fittings at all building expansion joints and every 100 feet of continuous conduit.
22. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.
23. Provide identification of all raceways, including conduit and wireways as specified in SECTION 26 05 53.
24. Ground all raceways as specified in SECTION 26 05 26.

B. Rigid Steel Conduit:
   1. For Materials and Designation: Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.
   2. Concealed:
      a. Install conceal conduit for lighting, convenience outlets, and other circuits in walls, ceiling, and floors where possible.
      b. Do not install conduit in concrete where conduit outside diameter exceeds one-third of concrete thickness.
      c. Use expansion and deflection fitting with bonding jumpers at all concrete expansion joints.
      d. Tie securely in place to prevent movement when concrete is poured.
      e. Install in floor slabs in as straight a run as possible. Conduit crossovers are not permitted unless conduit total outside diameter is one-third of the concrete thickness or less.

C. Rigid PVC Conduit:
   1. For Materials and Designation: Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.
   2. Make all joints watertight with cement compound furnished by the conduit manufacturer.
   3. Buried:
      a. Install in as straight a run as possible between termination points of exact routing to be determined in the field and subject to approval by Engineer.
      b. Bury conduits a minimum of 30 inches below finish grade unless indicated otherwise.
      c. Slope conduit away from building conduit risers down to handholes or manhole drains.
      d. Maintain 6-inch separation from underground piping.
      e. Use PVC-coated rigid steel elbows at all risers and at any bend greater than 45 degrees unless indicated otherwise.
      f. All risers shall be PVC-coated rigid steel conduit.
      g. After trench bottom has been finished to grade, lay conduit. Backfilling shall be as specified in DIVISION 2.
      h. Cap ends of all conduit risers before backfilling.

D. Liquid-Tight Flexible Metal Conduit.
   1. For Materials and Designation: Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.

2. Use between rigid conduit and motor terminal boxes except where conduit runs down from above and cannot be conveniently supported by a floor flange.
3. Place between rigid conduit or conduit box and control device cases where direct connection is not desirable for reasons of equipment movement, vibration, or for ease of maintenance.
4. Install at all points of connection to equipment mounted on supports to allow for expansion and contraction.
5. Conform to NEC with installation of conductors.
6. Install at locations where rigid conduit connections are impractical.
7. Use minimum length consistent with manufacturer's standard lengths, the acceptable bending radius, and with required movement of equipment.
8. Maximum length of 3 feet unless otherwise approved by Engineer.
9. Install an external bonding jumper to conform to NEC on conduit sized 1-1/2 inches and larger.
10. Install flex conduit with 15% extra length to allow the conductors and conduit room for vibration and expansion.

E. Conduit Fittings:
1. For Materials and Designation: Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.
2. Installations of special fittings are indicated.
3. Install as required.

3.03 BOXES AND FITTINGS:

A. For Materials and Designation: Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.
B. Install electrical boxes, bushings, locknuts, nipples, connectors, sealing hubs, and fittings as required, indicated, in accordance with applicable requirements of NEC and in accordance with recognized industry practices to fulfill Project requirements.
C. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
D. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.
E. All boxes containing emergency power and lighting circuits shall be identified as specified in SECTION 26 05 53 – Identification for Electrical Systems.
F. Provide (oil-tight) knockout closures to cap unused knockout holes where blanks have been removed.
G. Install electrical boxes in only those locations which ensure ready accessibility to enclosed electrical wiring.
H. Maximum box size in a fire-rated wall shall be 4 inches by 4 inches square. Do not install boxes back-to-back within walls. In walls that are not fire-rated or acoustic- rated, provide not less than 6 inches (150 mm) horizontal separation between boxes installed in opposite sides of wall. Provide not less than 24 inches (610 mm) horizontal separation between boxes installed on opposite sides of fire-rated and acoustic-rated walls.
I. Do not install aluminum products in concrete.
J. Position recessed outlet boxes accurately to allow for surface finish thickness.
K. Set floor boxes level and flush with finish flooring material.
L. Fasten electrical boxes firmly and rigidly to the surfaces to which attached, structural surfaces to which attached, or solidly embed them in concrete or masonry.
M. Provide electrical connections for installed boxes.

N. Properly ground metallic electrical boxes in compliance with the NEC. Bond all non-isolated equipment grounding conductors to all electrical boxes.
O. Subsequent to installation of boxes, protect boxes from construction debris and damage.
P. Install special boxes as indicated of size required for conduits and cables entering and leaving box.
Q. Ground boxes and fittings per SECTION 26 05 26 – Grounding and Bonding for Electrical Systems.

3.04 PAINTING:

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint with a brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.05 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 05 33

SECTION 26 05 43 – UNDERGROUND DUCT BANKS AND HANDHOLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION includes the following:
   1. Complete underground duct systems consisting of banks of nonmetallic ducts encased in reinforced concrete, and precast concrete handholes.
   2. All necessary earth and rock excavation and backfill.
   3. Removal and disposal of all excess excavation material.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. DIVISION 2 - Sitework
B. SECTION 26 00 00 - General Electrical Requirements
C. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems
D. SECTION 26 05 33 - Raceways, Boxes, Seals, and Fittings for Electrical Systems
E. SECTION 26 05 44 - Sleeves and Sleeve Seals for Electrical Raceways and Cabling
F. SECTION 26 05 53 - Identification for Electrical Systems

1.04 REFERENCE STANDARDS:

A. American Concrete Institute (ACI):
   1. 318-14 – Building Code Requirements for Structural Concrete.
B. American Society for Testing and Materials (ASTM):
   1. A48 – Standard Specification for Gray Iron Castings.
   2. C857 – Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
   3. C858 – Standard Specification for Underground Precast Concrete Utility Structures.
   4. D3917 – Dimensional Tolerance of Thermosetting Glass Reinforced Plastic Pultruded Shapes.
   5. D4385 – Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products.
   6. F512 – Standard Specification for Smooth Wall Polyvinyl Chloride (PVC) Conduit and Fittings for Underground Installation.
C. Federal Specifications:
   1. W-C-1094A – Conduit and Conduit Fittings Plastic, Rigid.
D. National Electrical Manufacturer's Association (NEMA):
   1. TC-2 – Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
   2. TC 6 – PVC and ABS Plastic Utilities Duct for Underground Installation.
   3. TC 8 – Extra Strength PVC Plastic Utilities Duct for Underground Installation.
   4. TC-14 – Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
E. Underwriters Laboratories, Inc. (UL):
   1. 651 – Schedules 40, 80, and A Rigid PVC Conduit and Fittings
   2. 651A – Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit.
   3. 1684 – Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.05 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.

B. Product Data: Submit the following for each type of product specified and included as minimum:
   1. Data sheets for each product supplied.

C. Shop Drawings: Provide the following as minimum:
   1. Submit shop drawings for fabrication and installation of pre-cast concrete structures and cast-in-place concrete structures including the following:
      a. Steel reinforcement drawings.
      b. Elevation showing openings, pulling irons, cable supports, sump, steps, covers, frames and other details.

D. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Certified "As-Built"/"As-Installed" drawings.
   2. Copies of all approved Product Data.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

1.07 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

B. Manufacturer Qualifications:
   1. The manufacturer shall be by a company specializing in providing precast products and services normally associated with precast-concrete construction. Design of precast handholes shall be prepared by a professional engineer licensed in the state associated with the project to conform to the procedures set forth in ACI 318 and applicable standards of this specification and of the size, shape, and details indicated or specified.

1.08 WARRANTY

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.

B. Warranty shall include all parts, labor, and expenses to perform necessary work.

C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Ducts:
   1. Carlon.
   2. Certain-Teed.
   3. Cantex.

B. Duct Spacers:
   1. Carlon.
   2. CertainTeed.
   3. Formex.

C. Concrete Inserts:
   1. Unistrut Corporation.
   2. B Line Systems, Inc.
   3. Engineer approved equal

D. Precast Handholes:
   1. Barbour Concrete Co.
   2. Champion Precast Inc.
   3. Old Castle.
   4. Engineer approved equal.

2.02 DUCTS:

A. Conduit Types for Concrete Encasement:
   1. Schedule 40 PVC:
      a. Tested to Underwriters' Laboratories, Inc. (UL) Standard UL 651A.

B. Conduit Types for Direct Bury:
   1. Schedule 80 PVC:
      a. Tested to Underwriters' Laboratories, Inc. (UL) Standard UL 651A.

C. Rated for use with 90°C conductors.

D. Provide with all necessary end bells, couplings, offset couplings, elbows, plugs, and other fittings.

E. Sizes as indicated.

F. Install PVC coated rigid galvanized steel elbows for all duct termination risers and all non-sweeping 90-degree bends.

G. Provide prefabricated, interlocking type plastic duct spacers for duct spacing as indicated.

2.03 REINFORCING STEEL:

A. Provide as specified in DIVISION 3.

2.04 CONCRETE:

A. Provide as specified in DIVISION 3.

B. Red colored concrete encasement shall use a red pigment integrally mixed into the concrete. Dry shake or broadcast coloring agents are not to be used.

C. Concrete shall be red dyed utilizing red dye mixed into the concrete for a minimum of 5 minutes prior to pouring. Minimum of 1 bag of dye per 1 yd of concrete.

2.05 POLYMER CONCRETE HANDHOLES:

1. Provide polymer concrete handholes similar to Quazite, Old Castle, or approved equal.
2. Provide size as shown on drawings, or as necessary based on NEC Fill calculations. Contractor to verify size requirements.
3. Provide polymer concrete handholes with load ratings as necessary based on final location.
   a. Located within drives, parking areas, or other areas likely to receive heavy vehicle traffic, or loading from crane outriggers: HS20.

2.06 WARNING TAPE:

A. Standard detectable warning tape, 4-mil 3 inch wide tape, red with black letters imprinted with "CAUTION BURIED ELECTRIC CABLE BELOW".

B. Metallic marker tape and 12 awg uf single strand tin coated copper tracer

2.07 "PULLING IN" ROPE:

A. Nylon or nylon equivalent composite.

B. Minimum average breaking strength: 2000 pounds.

PART 3 - EXECUTION

3.01 EXCAVATION AND TRENCHING FOR DUCT BANKS AND HANDHOLES

A. Perform as specified in DIVISION 2.
B. Work with extreme care near existing underground utilities to avoid damaging them.
C. Pitch the trench uniformly toward handholes or both ways from high points between handholes for required drainage.
D. Notify the Owner's representative for inspection prior to any duct bank installation and prior to concrete placement.

3.02 INSTALLATION:

A. Duct Banks:
   1. Ducts:
      a. Assemble as follows:
         (1) On spacers to maintain horizontal and vertical separation indicated.
         (2) With joints in adjacent ducts staggered.
         (3) All joints watertight by application of joint sealer compound furnished by duct manufacturer.
         (4) No reinforcing steel or other ferrous material between individual ducts.
      b. Securely tie overall at 5 foot or closer intervals as required.
      c. Secure to anchors after assembling to prevent flotation when placing concrete.
      d. Slope towards handholes with a minimum continuous slope of 1/2 percent.
      e. Align ducts for each 100 feet not greater than 4 inches horizontal.
      f. All risers and non-sweeping bends shall be PVC coated rigid galvanized steel as specified.
      g. Install end bells flush with face of concrete at each handhole and termination point unless indicated otherwise.
      h. Immediately after cleaning, install a "pulling in" rope in each duct, and plug each end of all ducts.
   2. Install warning tape along the entire length of duct banks at a depth of 12 inches below grade or as indicated on drawings.
   3. Run warning tape tracer wire to handhole with tracer wire test station.
   4. Reinforcing: Place as specified in DIVISION 3.
   5. Concrete:
      a. Mix with red dye for easy identification.
      b. Do not place prior to inspection and approval of duct and reinforcing installation by Engineer.
      c. Place as specified in DIVISION 3.
B. Handholes:
   1. Install a minimum of 6 inches of compacted granular material on undisturbed soil below handhole.
   2. Place at location and alignment as indicated.
   3. Top slab and handhole shall be set flush with finished grade when installed in paved areas, or 1” above finished grade in non-paved areas.
   4. Install conduits as indicated.
   5. Provide sufficient cable slack during installation to rack and secure cabling around the handhole walls.
   6. Clearances
C. Duct and Conduit Sealing:

1. Seal the ducts and conduits at building entrances and at outdoor equipment with a suitable non-hardening compound to prevent the entrance of moisture and gases.

3.03 BACKFILLING:

A. Provide backfill and compaction as specified in DIVISION 2.

3.04 ADJUSTING AND CLEANING:

A. Rod and clean all ducts with suitable cleaners, swabs and mandrels after completion of the duct bank.

3.05 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 05 43

SECTION 26 05 44 – SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION specifies the sleeves and seals Work by this Contract.
B. Provide raceway and duct seals including:
   1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
   2. Sleeve-seal fittings.
   3. Seal fittings.
   4. Silicone sealants.
   5. Duct seal.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 00 00 - General Electrical Requirements
B. SECTION 26 05 33 - Raceway, Boxes, Seals, and Fittings for Electrical Systems

1.04 REFERENCE STANDARDS:

A. ASTM International (ASTM):
   1. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   2. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
   3. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
B. Joint Industrial Council (J.I.C.):
C. National Fire Protection Association (NFPA):
   1. 70 - National Electrical Code (NEC).
D. National Electrical Contractors Association (NECA):
   1. NECA NEIS 1 - Standard for Good Workmanship in Electrical Construction.
E. National Electrical Manufacturers Association (NEMA):
   1. NEMA VE 2 - Cable Tray Installation Guidelines

1.05 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Product Data:
   1. Submit manufacturer's technical product data, including specifications and installation instructions, for each type of product required. Include data substantiating that materials comply with requirements.
   2. Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve, and seal.
   3. Submit listed systems for penetrations expected to be encountered.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

1.07 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

1.08 COORDINATION:

A. Coordinate size and location of sleeves. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete specifications.
B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.09 WARRANTY

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Wall Entrance Seals:
   1. O.Z./Gedney, Emerson Electric Company.
   2. Engineer approved equal
B. Duct Seal:
   1. Ideal Industries, Inc.
   2. The 3M Company.
   3. Engineer-approved equal.

2.02 SLEEVES:

A. Round Sleeves:
   1. Steel Wall Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
   2. Cast-Iron Wall Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
   3. PVC-Pipe Sleeves: ASTM D1785, Schedule 40.
   4. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
   5. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
B. Rectangular Sleeves:
   1. Rectangular, galvanized-steel, sheet metal sleeves.
   2. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.03 SLEEVE-SEAL SYSTEMS

A. Options:

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

B. General Characteristics: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit must have plastic or rubber waterstop collar with center opening to match piping OD.

2.04 GROUT:

A. Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 5,000-psi (34.5-MPa), 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

2.05 POURABLE SEALANTS

A. Single-component, neutral-curing elastomeric sealants of grade indicated below.
B. Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2.06 FOAM SEALANTS

A. Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam. Foam expansion must not damage cables or crack penetrated structure.

2.07 CONDUIT WALL ENTRANCE SEALS:

A. Provide where required or indicated.
B. Use O.Z./Gedney Company Type FSK, or Engineer approved equal for new walls.
C. Use O.Z./Gedney Company Type CSM or Engineer approved equal for penetration in existing walls.

2.08 SEAL FITTINGS AND COUPLINGS FOR RIGID STEEL, AND PVC-JACKETED RIGID STEEL CONDUIT:

A. Fittings:
1. Cast malleable iron fittings (for rigid steel conduit).
2. Explosionproof.
3. Cast malleable iron.
4. Threaded cover to conform to NEC.
5. Full thread hubs.
6. Seal compound well for seal.
7. Drain seals as indicated or required to provide a continuous automatic drain of water.
8. "Chico" compound for all sealing fittings.
9. PVC jacketed in corrosive areas where PVC-jacketed conduit is used.
10. Oversized to allow full cross section matching raceway and not reduce fill ratio.

B. Couplings:
1. Explosionproof.

2. Flexible.
3. Conform to NEC.
4. Threaded steel end fittings, matching conduit type, securely fastened to the core and braided to ensure electrical continuity.
5. PVC jacketed in corrosive areas where PVC-jacketed conduit is used.

2.09 DUCT SEAL:

A. Duct Seal:
1. Noncorrosive, permanently soft compound.
2. Nontoxic.
3. Provide flexible re-enterable and repairable seal around cables in conduits.
4. Prevent air movement and drafts through conduits.
5. Provide Ideal Industries Duct Seal, 3M® Moldable Putty, or Engineer-approved equal.

2.10 SILICONE SEALANTS:

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.01 SEAL FITTINGS:

A. Comply with NECA 1.

B. For sealing conduits within or leaving hazardous areas, provide seal fittings sized large enough to full use of the NEC allowed conduit capacity.

C. Install duct sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed duct raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install duct sealing fittings in accordance with NFPA 70.

D. Install devices to seal duct raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of duct raceways at the following:
1. Conduits pass from warm to cold locations.
2. Underground service duct raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Around cables at all conduit terminations at control panels
5. Boxes containing terminations and splices.
6. Where otherwise required by NFPA 70
7. Install necessary fittings in locations indicated and as required by code.

E. Wall, Roof and Floor Seals: Provide sleeves for conduit which penetrate foundation walls below grade, floors, ceilings, or exterior walls. Caulk between sleeve and conduit with nontoxic, UL-classified caulking material to ensure watertight seal.

F. Sleeve Seals: Provide modular mechanical type seals, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened,

providing watertight seal and electrical insulation. Seal fire rating shall equal or exceed that of the wall or floor penetrated.

G. Provide a fire-rated sleeve and seal equal to or exceeding the fire rating of the ceiling, floor or wall being penetrated. Fire-rated Sleeve and seal systems provided are to comply with engineer approved UL Listed systems. Coordinate with Engineer to gain approval of new penetration types requiring fire-rated sleeve and seal systems not yet approved.

H. Provide through floors, walls, and roofs as necessary for conduit or cable tray runs, including approved flashing and weather proofing at outside walls and on roofs.

I. Install sleeves or forms for all openings in new Work.

J. Provide the required inserts and holes, completely sleeved, bonded, curbed, flashed, and finished off in an approved manner, whether in concrete, steel grating, metal panels, or roofs.

K. Core-drill all holes required in existing building work using a dustless method.

L. Place non-shrinking grout or Dow Corning 3-6548 Silicone RTV, General Electric RTF 762 sealant or Engineer approved equal, in the following locations:
   1. All holes in concrete, walls, floor, and roof slabs after installation of conduit.
   2. All unused holes and sleeves as approved by Engineer.

M. Install wall entrance seals where conduit enters the building or vaults from exterior underground.

N. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
   1. Size pipe sleeves to provide 1/4 inch annular clear space between sleeve and raceway or cable, unless sleeve-seal system is to be installed, or seismic criteria require different clearance.
   2. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

O. Aboveground, Exterior-Wall Penetrations: Seal penetrations using galvanized steel or cast-iron pipe sleeves and mechanical sleeve-seal systems. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

P. Underground, Exterior-Wall and Floor Penetrations:
   1. Install cast-iron pipe sleeves with integral waterstops. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Install sleeve during construction of floor or wall.
   2. Install steel pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Grout sleeve into wall or floor opening.

3.02 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 05 44

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This Section specifies electrical identification work including the following:
   1.
   2. Electrical power, control, and communication conductors (and raceways).
   3. Operational instructions and warnings.
   4. Danger, caution and warning signs.
   5. Equipment/system identification nameplates.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 05 19 – Low Voltage Conductors and Cables
B. SECTION 26 05 73 – Electrical Studies.

1.04 REFERENCE STANDARDS:

A. Applicable Standards: Comply with the applicable requirements of the following standards.
   1. American Society of Mechanical Engineers (ASME):
      a. A13.1 - Scheme for the Identification of Piping Systems.
   2. Federal Specifications (FS):
      a. FS L-P-387 - Polyethylene Low and Medium Density – Molding Material (for designation plates).
   3. National Electrical Manufacturers Association (NEMA):
      a. Z535.1 - Safety Colors.
      b. Z535.4 - Product Safety Signs and Labels.
   4. National Fire Protection Association (NFPA):
      a. 70 - National Electrical Code (NEC), as applicable to installation of identifying labels and markers for wiring and equipment.
      b. 70E - Electrical Safety in the Workplace.
      c. 72 - National Electric Safety Code (NESC) – IEEE C2.
   5. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910.144 - Safety Color Code for Marking Physical Hazards.
      b. 29 CFR 1910.145 - Specifications for Accident Prevention Signs and Tags.
   6. Underwriters Laboratories (UL), pertaining to electrical identification systems:
      a. 969 - Standards for Marking and Labeling Systems.

1.05 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Product Data: Submit manufacturer's data on electrical identification materials and products.
C. Samples: Submit samples of each color, lettering style, and other graphic representation required for each identification material or system.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

1.07 QUALITY ASSURANCE:

A. Comply with ASME A13.1.
B. Comply with NFPA 70.
C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
D. Comply with NEMA Z535.4 for safety signs and labels.
E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.08 COORDINATION:

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
C. Coordinate installation of identifying devices with location of access panels and doors.
D. Install identifying devices before installing acoustical ceilings and similar concealment.

1.09 WARRANTY

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide electrical identification products of one of the following (for each type of marker):
   1. Brady Worldwide, Inc.
   2. Panduit Corp.
   3. Seton Identification Products.
   4. Thomas & Betts Corp.

2.02 ELECTRICAL IDENTIFICATION MATERIALS:

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option; but provide single selection for each application.
B. Orange "Emergency" and “( )-VOLT" Conduit, Equipment, Box Markers:
   1. General: Self-adhesive vinyl tape marker not less than 3 mils thick. Provide 1-1/8 inch wide by 4-1/2 inch long marker for 2 inch and smaller conduit. Provide 2-1/4 inch wide by 9 inch long marker for 2-1/2 inch and larger conduit. Except as otherwise indicated,

provide black lettering which indicates highest voltage of cables(s) in. Provide black lettering that indicates "Emergency" power circuit is in conduit.

2. Colors: Unless otherwise indicated or required by governing regulations, provide orange background tape marker.

C. Underground Type Plastic Line Marker:
   1. General: Permanent, bright-colored, continuous-printed plastic tape marker, intended for direct-burial service; not less than 6 inches wide by 4 mils thick. Provide tape marker with printing which most accurately indicates type of service of buried cable or duct bank. (Provide embedded continuous metallic strip or core when used with non-metallic conduit and fiber optic cable to enable locating.)

D. Conduit, wireway identification tags:
   1. Instrument, 600V Control, and Power: Use labels with 2-inch black letters identifying.
   2. Label adhesive to be able to hold on curved surfaces and withstand temperatures up to 150ºF, in indoor or outdoor environments.
   3. Labels to be resistant to oil, dirt, and abrasion.
   4. Made by Brady Corporation:
      a. Numbers generated with the BBP31 or BBP33 printer, with each raceway number on a continuous white background strip.
      b. Text size of 2 inches high with 1 character per inch on white background.
      c. Label size of 2.25 inches high.
      d. Utilize B-595 indoor/outdoor vinyl.
   5. Made by Electromark Company:
      a. Each label generated on a continuous white background strip.
      b. C-1003 series.
      c. Label size of 2.5 inch high.
      d. Text size of 2 inches high with 1 character per inch on a white background of 6-mil polyester film.
      e. Suitable for outdoor installation in all environments.
         (1) Long lasting performance in all environments.
         (2) Permanent adhesive for cold weather installation.
         (3) UV resistant ink.
         (4) Furnish with wrap around bands to insure that the identification tags will not lift off.
   6. Engineer approved equal.

E. Wire/Cable Identification Bands:
   1. Allen Marking Products.
   2. Panduit.
   3. Specialty Products Company.
   4. Thomas and Betts.
   5. Brady Corporation.
   6. General: Vinyl-cloth self-adhesive cable/conductor markers of wrap-around type, print-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification number indicated on Drawings or Shop Drawings.

F. Plasticized Tags:
   1. General: Preprinted or partially preprinted accident-prevention and operational tags, on plasticized card stock with matt finish suitable for writing, approximately 3-1/4 inches by 5-5/8 inches, with brass grommets and wire fasteners, and with appropriate preprinted wording, including large-size primary wording, e.g., "DANGER, DO NOT OPERATE." Tags shall comply with OSHA requirements.

G. Self-Adhesive Plastic Signs:
   1. General: Self-adhesive or pressure-sensitive, preprinted, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application, e.g., "EXHAUST FAN."
      a. Colors: Unless otherwise indicated or required by governing regulations, provide white signs with black lettering.

H. Baked Enamel "Danger" Signs:
   1. "DANGER" signs of baked enamel finish on 20-gauge steel (unless specified otherwise); of standard safety red, safety black, and safety white as defined by NEMA Z535.1; 14 inches by 10 inches size, except where 10 inches by 7 inches is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., "_____VOLTS, KEEP AWAY." Sign shall conform to OSHA and NEMA Z535.4.

I. Baked Enamel "Caution" Signs:
   1. "CAUTION" signs of baked enamel finish on 20-gauge steel (unless specified otherwise); of standard safety yellow with safety black letters; 14 inches by 10 inches size, except where 10 inches by 7 inches is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., "Caution for Ear Protection Required in this Area."

J. Based Enamel "WARNING" Signs:
   1. "WARNING" signs of baked enamel finish on 20-gauge steel (unless specified otherwise); of standard safety orange with safety black letters; 14 inches by 10 inches size, except where 10 inches by 7 inches is largest size that can be applied where needed and except where larger size is needed for adequate vision; with recognized standard explanation wording. Sign shall conform to OSHA and NEMA Z535.4.

K. Engraved Plastic-Laminate Nameplates:
   1. General: Engraving stock melamine plastic laminate nameplates, in sizes (minimum height of characters shall be 1/8 inch) and thicknesses specified or indicated, engraved with engraver's standard letter style of sizes and wording indicated, white face and black core plies (letter color) except as otherwise indicated, specified or required. Colors shall comply with OSHA and NEMA Z535.1. Nameplate shall be punched for mechanical fastening except where adhesive mounting is necessary because of the surface type it is mounted to, or where mechanical fastening will compromise the enclosure protection ratings.
      a. Thickness: 1/16-inch, for units up to 20 square inches or 8 inch length; 1/8-inch for larger units.
      b. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate surface it is mounted to.
   2. Lettering and Graphics:
      a. Coordinate names, abbreviations, and other designations used in electric identification work with corresponding designations shown, specified, or scheduled. Provide numbers, lettering, and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ASME A13.1 pertaining to minimum sizes for letters and numbers. Comply with OSHA requirements. Comply with design requirements of NEMA Z535.4.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION:

A. General Installation Requirements:
   1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions and requirements of NEC.
   2. Coordination: Where identification is to be applied to surfaces which require finish painting, install identification after completion of painting.
   3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit, wireway identification tags:
   1. General: Where exposed, apply identification markers at 20-foot intervals (visible from the floor) and within 3 feet of all panelboards, switchboards, switchgear, automatic transfer switches, emergency generators, substations, switches, devices, and circuit breakers (readily visible when standing in front of equipment). Identification on wireway shall be on outside of both sidewalls at 20-foot intervals.

C. Underground Cable, Conduit, and Duct Bank Identification Marker:
   1. General: During back-filling/top-soiling of each exterior underground direct buried electrical, signal or communication cable, conduit and duct bank, install continuous underground-type plastic line marker, located directly over the direct buried cable, conduit or duct bank at 12 inches below finished grade. Where multiple small direct buried cables are buried in a common trench and do not exceed an overall width of 16 inches, install a single line marker.
   2. Install line marker for every cable below grade, regardless of whether direct-buried, protected in conduit, or conduit in duct bank.

D. Wire/Cable Identification Bands:
   1. General: Apply cable/conductor identification bands, including circuit number, on each wire/cable in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

E. Wire/Cable Identification Bands:
   1. General: Apply cable/conductor identification bands, including circuit number, on each wire/cable in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.
   2. Refer to Interconnect Wiring Diagrams provided by System Integrator. Refer to SECTION 40 60 00 – Process Control and Instrumentation General Requirements.
   3. Wire labels to adhere to the following wire labeling format:
      a. AAAABBBBCCCC-DDDEEEEFF, where
      b. AAAA = Drawing number of interconnect wiring diagram provided by System Integrator.
      c. BBBB = Control Panel name.
      d. CCCC = Terminal number of wire in control panel.
      e. DDD = Field instrument designation type
      f. EEEE = Instrument loop number
      g. FF = Optional Indicator

h. Example: 0205MAIN0405-HS2400ES
   (1) 0205 - would be the wire label indicating sheet 0205 in the interconnect wiring diagram package provided by the System Integrator.
   (2) MAIN is the name of the enclosure/panel the wire terminates
   (3) 0405 is the terminal number the wire lands on
   (4) HS is a hand switch as designated by the P&ID symbol sheets.
   (5) 2400 is the equipment id/loop number as identified on the P&IDs and located on the electrical Drawings.
   (6) ES defines the HS device type, specifically as an E-Stop push button as identified by the P&ID symbol sheets.

F. Operational Identification and Warning Plasticized Tags and Metal Signs and Plastic Signs:
   1. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install signs with instruction or warnings. When signs are installed on switches, outlets, controls, devices and covers of electrical enclosures they may be self-adhesive vinyl or plastic. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.
   2. Where switchboards, switchgear, motor control centers, and panelboard are supplied by a feeder, provide an informational sign indicating each device or piece of equipment from where the power originates.

G. Danger Signs:
   1. General: In addition to installation of danger signs specified, indicated, and required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about Project.
   2. Install danger signs (with actual circuit voltage) on all building doors, substations, switchgear, switchboards, panelboards switches, circuit breakers, etc., wherever it is possible (under any circumstances) for persons to come into contact with electrical voltages to ground greater than 277V.
   3. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons or damage to or loss of property.
   4. Provide the following danger sign on the equipment indicated:
      a. "Danger This Machine Starts Automatically" on all fire pumps, air compressors and emergency generators.
   5. Provide the following danger signs on the doors leading to the equipment indicated:
      a. "Danger Hearing Protection Required" on all emergency generator room doors.
      b. "Danger: No Smoking, Matches or Open Flames" on all emergency generator room doors (, personnel doors opening into aircraft hangar,) and battery room doors.

H. Warning Signs:
   1. Provide an orange background sign with black letters reading "WARNING: LOAD SIDE OF SWITCH MAY BE ENERGIZED BY BACKFEED" on all tie switches and tie circuit breakers.
   2. Provide Arc Flash Warning signs on electrical equipment such as switchboards, switchgear, panelboards, industrial control panels, motor control centers and meter socket enclosures that are likely to require examination, adjustment, servicing, or maintenance while energized. Marking shall be permanently affixed and of a durable nature to

withstand the environment within which it is installed. Marking is to include date of Electrical Study confirming the stated values.

3. Provide Available Fault Current Warning signs on electrical equipment as specified in SECTION 26 05 73. Label shall include possible incident energy exposure within arc flash boundary in front of equipment as well as meet NFPA 70E for additional content.

I. Caution Signs:
   1. Provide yellow background caution signs with black letters on the doors leading to the equipment indicated:
      a. "Caution Ear Protection Required in this Area" on all emergency generator room doors.
   2. Provide the following yellow background caution sign with black letters on all panelboards, substations, switches, circuit breakers, and switchboards where turning off a circuit will automatically start an emergency generator:
      a. "Caution Turning Off this Circuit will Automatically Start Emergency Generator AAA-GEN-XXX"
   3. Provide the following yellow background caution sign with black letters on all automatic transfer switches, switches, circuit breakers, equipment, and emergency panelboards that are energized by the emergency power system:
      a. "Caution Automatically Energized by the Emergency Power System."

J. Equipment/System Identification Nameplates:
   1. General: Install engraved plastic-laminated nameplates on each major unit of electrical equipment in the building; including central or master unit of each electrical system including communication/control/signal/alarm systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2-inch high lettering on 1-1/2-inch high sign (2 inches high were two lines are required), black lettering on white field. Provide text matching terminology and numbering of the contract documents and shop drawings. Nameplate shall include unit designation, normal source circuit number ("Fed from..."), circuit voltage, and other data specifically indicated. Nameplate shall indicate normal source circuit number ("Fed from..."), and emergency source circuit number ("Fed from..."), when the equipment is a transfer switch or fed directly from a transfer switch. Provide nameplates for each unit of the following categories of electrical work:
      a. Switchboards, panelboards, electrical cabinets, and enclosures. (Include main bus ampacity on the nameplate.)
      b. Access panel/doors to electrical facilities.
      c. Major electrical switchgear (Include main bus ampacity on the nameplate.)
      d. Electrical substations (Include main bus ampacity on the nameplate.)
      e. Motor control centers, (Include main bus ampacity on the nameplate.) and individual motor starters.
      f. Disconnect switches.
      g. Push buttons, selector switches, indicating lights. (Circuit number and voltage not required on nameplate).
      h. Power transfer equipment: Contactors and transfer switches.
      i. Lighting control equipment and contactors.
      j. Remote controlled switches, dimmer modules, and control devices.
      k. Transformers (Include primary voltage, secondary voltage, number of phases, feeder, and panelboards or equipment supplied by the secondary.)
      l. Inverters. (Include input voltage, output voltage, number of input phases.)
      m. Rectifiers. (Include input voltage, output voltage, and number of phases.)

n. Frequency converters. (Include input and output frequency.)
o. Battery racks.
p. Power generating units.
q. Telephone cabinets and switching equipment. (Circuit number and voltage not required on nameplate.)
r. Clock/program master equipment.
s. Fire alarm and mass notification systems master station.
t. Security monitoring master station.
u. Public address system.
v. Uninterruptible power supplies (UPS).
w. Wireway used as auxiliary gutter tap locations with circuit number of circuit being tapped. Provide on outside of wireway.
x. Provide voltage identifying conduit markers on all conduit and pull boxes that contain medium voltage conductors.
y. Provide "EMERGENCY" conduit markers on all conduit and pull boxes that contain emergency power conductors.
z. Switchboard main switches and circuit breakers.

2. Install markers, tags, nameplates, and signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure the identification with fasteners, except use adhesive where fasteners should not or cannot penetrate surface.

3.02 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 05 53

SECTION 26 05 73 – ELECTRICAL STUDIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION includes computer-based fault-current (short circuit) analysis, overcurrent protective device coordination, and arc flash hazard studies.
B. Perform field data collection include cable length and enclosure size types and electrode configuration.
C. Perform fault-current (short circuit) analysis, overcurrent protective device coordination, and arc flash hazard studies.
D. The study shall be provided for the electrical distribution system components provided and include all power sources (normal and emergency) down to the branch circuit overcurrent protective device and equipment.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 05 53 – Identification for Electrical Systems.

1.04 REFERENCE STANDARDS:

A. The short circuit study shall be completed in accordance with the latest edition of the following standard:
   1. IEEE 3002.3 - Recommended Practice for Short-Circuit Calculations in Industrial and Commercial Power Systems.
B. The short circuit study and overcurrent protective device coordination and settings shall be completed in accordance with the latest edition of the following standards:
   1. IEEE 3001.5 - IEEE Recommended Practice for the Application of Power Distribution Apparatus in Industrial and Commercial Power Systems
   2. IEEE 3004.5 - Recommended Practice for the Application of Low-Voltage Circuit Breakers in Industrial and Commercial Power Systems.
   3. IEEE 3004.11 - Recommended Practice for Bus and Switchgear Protection in Industrial and Commercial Power Systems.
C. The arc flash hazard analysis and labels shall be completed in accordance with latest editions of the following standards:
   1. IEEE Standard 1584 - Guide for Performing Arc-Flash Hazard Calculations.
   2. NFPA70E – Standard for Electrical Safety Requirements for Employee Workplaces.

1.05 PERFORMANCE/DESIGN CRITERIA:

A. The short circuit study shall calculate the available short-circuit current at each bus in the electrical distribution system.
B. All overcurrent protective devices provided shall have an interrupting rating equal to or greater than the available short-circuit current at the point of application.
C. The study shall examine proper protection of electrical system components and utilization equipment such that the equipment has a sufficient short-circuit current rating.
D. The overcurrent protective device study shall analyze the system for selective coordination. This analysis shall identify any potential selective coordination problems including fault currents up to the available short-circuit current. Any areas where the overcurrent protective

devices are not selectively coordinated shall be explicitly noted and recommendations shall be made to achieve selective coordination.

E. The study shall include an arc flash hazard analysis for electrical distribution equipment. The analysis shall determine the flash protection boundary, incident energy, and required level of personal protective equipment (PPE) for workers at the electrical distribution equipment. The electrical distribution equipment shall be labeled with this information in accordance with codes, and standards; study must also coordinate with the Owners existing arc flash hazard system, if available and less than 5 years old.

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.

B. Qualifications.

C. Product Data:

1. Computer analysis software application name, provider and version.

D. The results of the studies shall be summarized in report format with an explanation of how to interpret the data.

E. As a minimum the report shall include the following:

1. Short-Circuit Study:
    a. Printout of input data and calculated results.
    b. One-line diagram identifying all bus locations, and the maximum available three-phase and line-to-ground short-circuit currents at each bus.
    c. Bus-to-bus listing of the maximum available short-circuit current expressed in RMS symmetrical amperes and the X over R ratio of that fault current.
    d. A table of specified equipment short-circuit ratings versus calculated short-circuit current values with notations of locations where are specified equipment short-circuit ratings are less or greater than required at the point of application.
    e. An analysis of the results in which any overrating or inadequacies shall be called to the attention of the Engineer and recommendations made for improvements.
2. Protective Device Coordination Study:
    a. Time-current characteristic curve drawings on log-log printouts which illustrate:
        (1) The recommended settings for all adjustable relays, overcurrent protective devices and ground fault protective devices provided for the project.
        (2) The key or limiting overcurrent device characteristics, load characteristics, and protection requirements affecting the settings or ratings of the overcurrent protective devices supplied.
        (3) The degree of selective coordination achieved with the overcurrent protective devices supplied.
    b. Tabulation of the recommended settings for all adjustable relays, overcurrent protective devices and ground fault protective devices and type selections for fuse protective devices supplied.
    c. An analysis of the results in which any inadequacies related to selective coordination shall be called to the attention of the Engineer with recommendations for improved coordination.
3. Arc Flash Hazard Analysis Study:
    a. Include the following for each piece of switchgear, switchboard, motor control center, distribution panel, panelboard, automatic transfer switch, enclosed circuit breaker, disconnect switch, and equipment control panel installed on the project:

(1) Minimum Arc Fault Current, Arc Flash Boundary and Arc Fault Incident Energy Level (cal/cm2).
(2) Risk of personnel injury as a result of exposure to incident energy released during an arc flash event.
(3) Appropriate ratings of personal protective equipment (PPE).
(4) The Flash Protection Boundary (approach limit distance).
(5) Information for equipment specific arc-flash hazard warning labels.

b. Recommendations and methods to mitigate the hazard risk, where applicable, to reduce PPE requirements.

4. Cut sheets and label specification information on the Arc Flash warning labels being provided.
5. Closeout Submittal: Provide complete set of calculation files (SKM PTW, ETAP, etc.) to customer.

1.07 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. The company and individual(s) performing the study shall have a minimum of 5 years documented experience in power system analysis and completed projects of similar size and scope. The individual(s) performing the study shall be a registered Professional Engineer in the state where the Project is located. All elements of the study shall be performed under the direct supervision and control of a Professional Engineer.
C. The company performing the study shall have the capability and experience to aid during system start up.
D. Comply with IEEE 3002.3-2 for short-circuit currents and coordination time intervals.
E. Comply with IEEE 3001.5 for general study procedures.
F. Comply with IEEE 1584 or NFPA 70E for arc flash hazard analysis.

1.08 SEQUENCING AND SCHEDULING:

A. The selection of the company and the individual performing the study shall be submitted and approved by the design Engineer prior to the start of the study.
B. Short Circuit study is to be submitted based on equipment intended to be provided but not yet approved. Study is to be approved prior to purchase orders for equipment being issued. Equipment where the specified short circuit current ratings are not sufficient shall be explicitly noted and recommendations shall be made to achieve selective coordination.
C. The final study shall be completed and submitted and approved prior to the facility startup.

1.09 WARRANTY

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 GENERAL:

A. The short circuit, protective device coordination, and flash hazard analysis study shall be completed with the aid of a computer software program such as ETAP, SKM Power Tools, or Engineer approved equal.
B. The Contractor shall provide all lengths of cable for use in the studies.

C. All equipment ratings, make, and model information shall be obtained by the Contractor from the equipment manufacturers and/or suppliers and provided for use in the studies.
D. Information on the electrical service including available fault current, transformer impedance, primary fuse ratings, primary cable size, and any other required information shall be obtained from the local utility for inclusion in the studies.
E. The study shall be inclusive of the entire electrical distribution system from all power sources (normal and emergency) down to the branch circuit overcurrent protective device and equipment.
F. Separate calculations shall be performed for both the normal and emergency sources. Device settings shall be based upon the normal (utility) source study.
G. The Arc Flash Study shall be based on the source, normal or emergency, that results in the highest incident energy.

2.02 SHORT CIRCUIT COORDINATION STUDY:

A. The short circuit study shall as minimum include the following:
   1. A schematic one-line drawing of the entire electrical system included in the study, from the electrical utility source including the point of delivery, to each primary transformer, and including all main secondary buses of each transformer included in the study. Secondary buses shall include multiple secondary transformations within the scope of the study. Each device shall be identified by the Engineer assigned equipment tag number indicated on the Contract Documents. Each motor greater than 1 hp shall be shown and identified. Each bus shall be identified by the Engineer assigned equipment tag number indicated on the Contract Documents.
   2. Source voltage and impedance data shall be given in the analysis, including reactance and resistance in OHMS to the source, and available symmetrical and asymmetrical short circuit amperes at the point of delivery of electrical power. Short circuit amperes shall be based on utility provided information assuming a bolted three-phase and line-to-ground short circuits.
   3. At each bus, including buses of all primary protective and switching devices, primary and secondary of all transformers, all secondary main and feeder breakers, and all secondary devices and panelboards within the scope of the study, the following shall be calculated:
      a. Symmetrical RMS short circuit amperes calculated using total source and motor contribution reactance and resistance values.
      b. Asymmetrical average 3 phase RMS amperes at 1/2 cycle, calculated using actual total source and motor contribution X/R ratio.
      c. Reactance ("X") and Resistance ("R") in OHMS at the voltage of the device being examined, including both electrical utility source and all motor contributions.
   4. Calculation sheets for cable sections shall indicate voltage, wire size, cable length, reactance and resistance of the section in OHMS and total "X" and "R" to the source.
   5. Calculation sheets for transformer sections shall indicate transformer kVA, secondary voltage, percent impedance, percent reactance, percent resistance, and total "X" and "R" value in OHMS at the secondary voltage to source, including the electrical utility source impedance plus any primary motor contribution.
   6. Calculation sheets for busway and miscellaneous devices shall provide all pertinent parameters including operating voltage, section "X" and "R" values in OHMS, and total "X" and "R" values in OHMS to the source, based on source impedance plus any motor contribution.
   7. Bus summary sheets shall be provided giving consecutive bus numbers, description, voltage, "X" and "R" values in OHMS including the electrical utility source plus all

motor contributions, symmetrical and asymmetrical short circuit amperes, X/R ration, and asymmetrical factor.

8. Motor summary sheets shall provide motor description and all pertinent motor data including subtransient reactance for each motor greater than 1 hp. Symmetrical short circuit amperes shall be given for each motor at the motor terminals.

2.03 PROTECTIVE DEVICE COORDINATION STUDY:

A. The protective device coordination study shall as a minimum include the following:
   1. Time-current coordination plots shall be made on log-log software generated plots and shall graphically indicate the coordination proposed for all the key systems. The plots shall include complete titles, one-line diagram and legend.
   2. The electrical utility source relay, fuse, or protective device shall be plotted with all load protective devices at the same voltage.
   3. Transformer primary protective device, transformer magnetic inrush, transformer ANSI withstand points, secondary voltage fuse or circuit breaker and largest feeder fuse or circuit breaker shall be plotted at the secondary voltage. Circuit breaker curves shall include complete operating bands, terminating with the appropriate available short circuit current. Fuse curves shall be identified as either total clearing time or damage time as applicable.
   4. Low voltage circuit breakers shall have instantaneous, short delay, long-time pick-up and ground fault trip settings and ground fault ampere and time delay settings identified as plotted. Sensor or monitor rating shall be stated for each circuit breaker. All regions of the circuit breaker curve shall be identified.
   5. The coordination plots shall include significant motor starting characteristics and large motor protective devices.
   6. Feeder circuit breakers shall have the time-damage curve of the feeder conductors plotted to indicate protection of the conductor insulation at the total clearing time of the circuit breaker or fuse. The time-damage point shall be calculated for the specific parameters of conductor insulation used, with average 3 phase RMS asymmetrical amperes as 1/2 cycle calculated using actual resistance and reactance values of the source plus all motor contributions which exist at the load end of the feeder conductors.
   7. A determination of settings or ratings for the overcurrent and ground fault protective devices supplied. Where necessary, an appropriate compromise shall be made between selective coordination and service continuity with selective coordination considered more important than system service continuity.
   8. A summary tabulation shall be provided listing manufacturer and type for all overcurrent protective devices and all recommended settings of each adjustable band included in each device.
   9. Settings of protective devices shall minimize the arc flash hazard while maintaining selective coordination.

2.04 ARC FLASH HAZARD ANALYSIS STUDY:

A. The arc flash hazard analysis study shall as minimum include the following:
   1. Calculate incident energy levels and flash protection boundaries at all relevant equipment busses based on available short-circuit current, protective device clearing time, field data and other applicable one-line diagram information in accordance with IEEE - 1584.
   2. As a minimum, the following shall be calculated for each piece of switchgear, switchboard, motor control center, distribution panel, panelboard, automatic transfer

switch, enclosed circuit breaker, disconnect switch, and equipment control panel to be installed on the project:
   a. Minimum Arc Fault Current, Arc Flash Boundary and Arc Fault Rating (cal/cm2).
   b. Risk of personnel injury from exposure to incident energy released during an arc flash event.
   c. The appropriate ratings of personal protective equipment (PPE).
   d. The Flash Protection Boundary (approach limit distance) as required by NFPA 70E.
3. Provide equipment specific arc-flash hazard warning label requirements per NFPA 70E, including all information specified to be provided on individual equipment warning labels.
4. Provide recommendations and incorporate with the protective coordination study methods to mitigate the hazard risk, where applicable, to reduce PPE requirements.

B. Provide self-adhesive or plastic arc flash and available fault current labels for all electrical equipment in accordance with NFPA 70E.
1. Self-adhesive or pressure-sensitive, preprinted, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility.
2. Refer to SECTION 26 05 53 for label specifications.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are as indicated on Drawings.

B. Proceed with coordination study only after relevant equipment submittals have been approved and assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

C. Prior to final electrical equipment selection Contractor shall review the short circuit study recommendations for the electrical Equipment ratings and provide Equipment that meets or exceeds those recommendations.

3.02 SETTINGS AND SELECTION:

A. Prior to project Substantial Completion, the Contractor shall:
1. Provide all current limiting fuses, and fused disconnects as required to for equipment to meet the short circuit ratings of the system.
2. Set all relays, overcurrent devices and ground fault protection devices:
   a. Relays: Reset all adjustable relay settings from the factory default settings to the settings recommended in the studies specified in this SECTION.
   b. Circuit Breakers and Motor Circuit Protectors: Reset all adjustable trip settings from the factory default settings to the settings recommended in the studies specified in this SECTION.
   c. Ground Fault Protection Devices: Reset all adjustable device settings from the factory default settings to the settings recommended in the studies specified in this SECTION.
3. all fuses that do not meet the recommendations of the studies specified in this SECTION with fuses that are recommended.

B. Certification: Prior to project Substantial Completion, the Contractor shall submit a document certifying that the Contractor has completed the settings and selection scope specified to the Engineer.

3.03 INSTALLATION:

A. Provide Arc Flash Warning signs on electrical equipment such as switchboards, switchgear, panelboards, industrial control panels, motor control centers and meter socket enclosures. Marking shall be permanently affixed and of a durable nature to withstand the environment within which it is installed. Thoroughly clean equipment surfaces prior to installation of labels.

3.04 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 05 73

SECTION 26 08 10 - ELECTRICAL TESTING & MAINTENANCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION covers field testing of all wire, cable, and electrical equipment as it pertains to the project.

1.03 RELATED TECHNICAL REQUIREMENTS

A. DIVISION 26 - Electrical
B. SECTION 40 05 93 - Common Motor Requirements for Water and Wastewater Equipment

1.04 REFERENCE STANDARDS:

A. American National Standards Institute (ANSI):
   1. C2 - National Electrical Safety Code (NESC).
B. American Society For Testing and Materials (ASTM):
   1. D1816 - Standard Test Method for Dielectric Breakdown Voltage of Insulating Oils of Petroleum Origin Using VDE Electrodes.
C. National Fire Protection Association (NFPA):
   1. 70 - National Electrical Code (NEC).
   2. 70E - Standard for Electrical Safety in the Workplace
   3. 70B - Standard for Electrical Equipment Maintenance
   4. 110 - Standard for Emergency and Standby Power Systems.
D. Institute of Electrical and Electronic Engineers (IEEE):
   1. No. 43 - Recommended Practice for Testing Insulation Resistance of Rotating Machinery.
   2. No. 62.2 - Guide for Diagnostic Field Testing of Electric Power Apparatus Electrical Machinery.
E. International Electrical Testing Association (NETA):
   1. ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.

1.05 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Test Reports:
   1. Submit as specified in DIVISION 1.
   2. Submit personnel qualifications. Submit samples of test reports for approval prior to performing tests.
   3. Include calibration reports for equipment used within the report.
   4. Maintain a written record of all tests and inspections showing date, testing equipment used, personnel making test, equipment or material tested, tests performed, and results, including deficiencies found and corrective actions taken. Test reports shall include nameplate data of equipment being tested.
   5. Provide infrared scanning report.
   6. Maintain a written record of preventative maintenance measures taken.

7. Subcontractor may use his or her standard forms to record all data required by these Specifications.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

1.07 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

1.08 PERSONNEL QUALIFICATIONS:

A. Personnel shall have the following qualifications:
   1. Shall be thoroughly familiar with power distribution and test equipment and be expert in setting, calibrating, and testing protective relays.
   2. Shall have proven ability in the above mentioned areas of work with a minimum of five years' experience. For each person furnished with the above experience, a testing assistant may be furnished with a minimum of two years of similar experience to accompany.
   3. Shall be able to supply references and proof of experience and ability to keep good test records on recent projects.
   4. Shall be familiar with developing testing procedures and schedules.

B. Responsibilities:
   1. Perform inspections, tests, and preventative maintenance as specified.

PART 2 - PRODUCTS

2.01 TESTING EQUIPMENT:

A. Necessary testing equipment which may include, but not be limited to, the following:
   1. All apparatus and material as required by referenced Standards.
   2. Wet and dry bulb thermometers.
   3. 500-, 1,000- and 2,000V insulation test sets (e.g., meggers).
   4. Battery-powered ringing set.
   5. Non-Destructive test equipment:
      a. DC high potential test set, adjustable up to 90 kV.
      b. VLF Test set
      c. Tan Delta test module
      d. Partial Discharge tester
   6. 125/250/500Vac voltmeters, and three 0-5-amp, ac ammeters 0.5% accuracy.
   7. Simpson Model 260 volt-ohm-milliammeters (or Engineer-approved equivalent).
   8. Phase rotation meters (Amprobe PRM-4 or equivalent).
   9. Phase angle meter, 60 cycle.
   10. Portable synchronizing lights.
   11. Relay Test Set:
      a. Doble F-2250.
      b. Doble F-6150.
      c. Approved equivalent.
   12. Transformer ratio tester "TTR."
   13. Digital low resistance ohmmeter capable of 100A minimum.
   14. Miscellaneous test leads, jumpers, cable, switches, receptacles, plugs, and other equipment as necessary.

15. Radio communication units as required for each test crew.
16. Signal source for control loops (4-20 mA, 1-5Vdc, etc.).
17. Thermocouple measuring equipment.
18. A portable test set for testing the overcurrent trip devices provided on the 480V load center.
19. Laptop computer capable of loading relay software.
20. 125Vdc power supply capable of powering equipment to be tested.
21. Infrared thermography equipment.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS:

A. Conform to requirements as specified in DIVISION 1.
B. Furnish labor, test equipment, and materials as follows for specified inspections and tests.
C. Perform specified inspections and tests and report all deficiencies in equipment and materials to Engineer/Owner. Minor, easily correctable deficiencies shall be corrected and reported to Engineer/Owner.
D. Follow manufacturers' recommendations regarding test voltages to be used for insulation-resistance and overpotential tests.
E. Include all tests recommended by the NETA Acceptance Testing Specifications.
F. Measured test values shall be in accordance with NETA.
G. Test all wire, cable, and electrical equipment installed or connected by Contractor to assure proper installation, setting, connection, and functioning as indicated or to conform to Contract Documents and manufacturer's instructions.
H. Include all tests recommended by the Equipment manufacturer unless specifically waived by Engineer.
I. Repair equipment and materials furnished by others if requested by the Engineer or by manufacturer's field service representative. Negotiate with the requesting party.
J. Be responsible for any damage to equipment or material due to improper test procedures or test apparatus handling, and replace components as require, or restore to original condition, at Engineer's option, any damaged equipment.
K. Furnish and use safety devices such as protective screens and barriers, yellow tape, danger signs, and related items to adequately protect and warn all personnel in the vicinity of the tests.
L. Furnish qualified personnel acceptable to Engineer/Owner.
M. Certain inspections and tests specified to be performed by this Contract may also be performed by others with prior Engineer/Owner approval.
N. Engineer/Owner will approve the testing schedule of all electrical testing and inspections. Cooperate and work closely with Engineer/Owner during all phases of work, especially with respect to the following:
    1. Sequence and priorities of energizing and de-energizing equipment.
    2. Testing and testing methods.
    3. Lock-out/Tag-out procedures for personnel and equipment safety.
O. Accompany Engineer's electrical engineer for a thorough review of completed testing prior to energization of tested equipment.
P. Once testing activity begins, Engineer shall establish a permanent testing crew of experienced electricians used for testing similar equipment. Engineer’s supervisor shall attend jobsite meetings as requested by Owner.

Q. Add personnel to the testing crew as required to have all testing completed in accordance with the dates listed in the Engineer's provided testing schedule and in accordance with the requirements of DIVISION 1.
R. Testing is expected to be performed during upcoming planned plant outage, so all testing will be done during normal business hours, unless the Engineer's schedule is not being met.
1. Prepare reports of all testing performed.
2. Furnish personnel as required to maintain Project schedule.

3.02 INDIVIDUAL DEVICE AND EQUIPMENT INSPECTIONS AND TESTS:

A. Low-Voltage Power Distribution Equipment:
1. Check and measure equipment ground; notify Engineer if more than one ohm.
2. Remove, or draw-out, all potential transformers. Put all breakers into the closed position.
a. Using the 10-minute and 1-minute insulation resistance values, provide polarization index ratings for all tested equipment.
3. Test and record contact resistance on each phase of each bus section.
4. Perform other tests recommended by the manufacturer to ensure correct operation. Optional scope to include the following:
a. Check accessible bus connections with torque wrench or low-resistance ohmmeter.
b. Verify automatic transfer.
c. Test CT's and for proper ratio and insulation resistance.
d. Test Ammeters and voltmeters by applying appropriate signals.
e. Test ground and bonding connections.
f. Test protective relays.
g. Verify proper tripping operation of breakers using protective devices.

B. 600V Molded-Case Breakers:
1. Inspect adjustable magnetic trip unit settings and compare to values in most recent electrical study.
2. Megger each pole for freedom from grounds.
3. Check for proper current rating for circuit to which connected.
4. Open and close each breaker manually checking for expected operation.

C. Dry Type Transformers:
1. Verify nameplate data.
2. Winding tests:
a. TTR at all taps.
b. Megger winding to winding.
c. Megger each winding to ground.
3. Check equipment ground to assure continuity of connections.
a. Notify Engineer/Owner if ground is more than one ohm.
4. Check electrical neutral of the transformer, if present.
5. Check for proper operation of the winding temperature gauge and cooling fans.
6. Before re-energizing:
a. Check polarity and magnetization current of the transformer.
b. Check connections for proper torque/tightness.
c. Clean out dust, and other foreign material.
d. Return transformer tap setting to original position.

D. Low Voltage Starters and Contactors:
1. Check equipment ground to assure continuity of connections.
2. Check magnetic coil for proper rating.
3. Clean all contacts and magnetic surfaces (as required).

4. Check all auxiliary contacts for correct arrangement with coil de-energized; i.e., normally open or normally closed.
5. Check all fuses or air circuit breakers for proper rating.
6. Check field connections for tightness.
7. Check secondary fuses on motor starter control power transformer supply.
8. Set motor circuit protectors (MCP) instantaneous setting and set overload device to proper setting based on motor nameplate full load amps in accordance with NEC.
9. Perform additionally required inspections and tests according to Owner provided Operations & Maintenance Manuals.

E. Motor Tests on All Motors:

1. Check Equipment ground to assure continuity of connections as specified in DIVISION 26.
2. Measure the insulation resistance of the stator winding before applying voltage. Compare this measured value against the manufacturer's value. If there is no insulation resistance value furnished by manufacturer, use the following:

Motor Voltage	Insulation Resistance
600 volts and below	5 megohms

If measured resistance values are lower than above, record room temperature and humidity and submit readings to Engineer before energizing. Dry out motors as required by accepted method of application of external heat, and do not apply voltage to motor until substandard resistance condition is corrected. Megger readings are to be one-minute duration, using a 500V megger for all motors 600V and below.

3. Perform a Dielectric Absorption Test and Polarization Index Test. While performing insulation resistance test on motors, continue test for a period of ten minutes, recording values at 15 sec, 30 sec, 45 sec, 1 minute, 2 minutes, 5 minutes, and 10 minutes.
   a. The Dielectric Absorption Test results are found using the dielectric absorption ratio (DAR) by comparing the insulation resistance at 30 seconds to the resistance at 60 seconds. Compare the DAR against the table below.

Insulation Condition	**60/30-Second DAR Value**
Questionable	1.0-1.25
Good	1.4-1.6
Excellent	>1.6

   b. The Polarization Index is a similar test that uses a 10/1-minute ratio.

Insulation Condition	**60/30-Second DAR Value**
Dangerous	<1.0
Questionable	1.0-2.0
Good	2.0-4.0
Excellent	>4.0

4. Prior to final Equipment alignment, disconnect motor from driven Equipment where necessary to check lubrication, starter, and control circuits. If motor is free of dirt and dust, rotate rotor by hand to determine that motor turns freely. Clean out motor if

necessary. Apply voltage momentarily and note direction of rotation. Correct rotation if necessary. Reconnect motor to driven equipment.

5. After the motor is placed in operation, observe the motor for heating at the bearings or windings. If the motor appears to be running hot, notify Engineer. Note: General purpose motors may reach temperatures up to 176ºF with a room temperature of 104ºF.
6. Take motor full-load amps readings (on all three legs of three-phase motors). Submit results to Engineer.

F. Control and Instrument Switch Tests:
   1. Inspect all contacts and shunts, cleaning contacts if required.
   2. Operate switch and note that all design functions are performed in proper sequence.

G. Power Switches (Disconnects and Safety):
   1. Inspect contacts and clean if required.
   2. Inspect arc chutes if provided on switch.
   3. Inspect fuses for proper rating if furnished on switch.
   4. Operate switches (de-energized) for proper functioning.

H. Transfer Switches:
   1. Test transfer switches by connection of normal and standby sources.
   2. De-energize the normal source and observe that the switch transfers to the standby source and then returns to the normal source when it is restored.
   3. Adjust all contacts for proper alignment and minimum arcing.
   4. Observe that all auxiliary contacts which alarm or operate other devices perform their intended functions as indicated.

I. Pressure Switches, Float Switches and Limit Switches:
   1. Inspect and test switches to conform to manufacturer's recommended field tests.
   2. Adjust switches to perform the design function for proper Equipment operation.

J. Instruments:
   1. Ammeters:
      a. Check connections from current transformers.
      b. Check ammeter scale for agreement with current transformer ratio.
      c. Set pointer on zero scale with no load.
      d. Voltmeter Tests: Check voltmeter range with corresponding potential transformer ratio.
      e. Set pointer on zero scale with no voltage.
      f. Check voltmeter reading with test voltmeter when energized.
   2. Power Factor and Varmeter Tests:
      a. Check polarities of instrument transformers and connect so lagging current will be to left of unity power factor.
   3. Wattmeter and Watt-Hour Meter Tests:
      a. Check with current transformer and potential transformer ratio.
      b. Set watt-hour pointer on zero scale with no load.
      c. Check rotation of watt-hour meters.
      d. Check accuracy of watt-hour meters as directed by the Equipment manufacturer's representative.
   4. Annunciator Tests:
      a. Check each unit of annunciators by closing or opening the trouble contact and observing operation of control board.
      b. Check all annunciator lamps, audible cutoff, and reset operation.

K. Instrument Transformer Tests:

1. Inspect polarity mark orientation on all CTs and PTs to conform to manufacturer's drawings.

L. Wire and Cable Tests: (Feeders and Control Circuits Only)
1. For 480V systems, megger all 600V insulated wire with a 1000Vdc megger for one minute, and values must not be less than 50 megohms per NETA ATS 7.3. Determine the values with all switchboards, panelboards, fuse holders, switches, and overcurrent devices in place. Do not connect motors and transformers during meggering. Megger wire and cable after installation and not on the cable reel.
2. Check all control cable by megger tests similar to those described for 600V insulated wire. Check all control wiring for tightness of terminal contacts and continuity (especially of current transformer leads) through each "run" of control circuiting. Thoroughly verify all wiring by means of battery-powered lights, buzzers, bells, or telephones. After completing these checks and tests on a given control circuit, attach a temporary cardboard tag on each end of cable tested which bears date and name of Engineer's representative responsible for checking. Follow this procedure for each control circuit cable. Provide all phasing tests and make all changes necessary to assure proper rotation of all motors, the correct phasing and phase sequence of all circuits susceptible to being paralleled, the proper polarity on all instrument transformer wiring, and such other phasing tests as may be required for the equipment being connected under this Contract.
3. Do not test cable with an ac test set. Disconnect cables from all equipment during testing. Testing cable on reel will not be acceptable. Make testing after installation but before final connection of equipment. Make high-potential tests phase-to- ground on each individual conductor.

M. Control Schemes Tests:
1. Test all electrical controls by trial operation of control equipment after all wiring is completed to see that each interlock and control function operates to conform to the description of operation, as indicated on the schematic diagrams, as well as with the manufacturer's operating instructions.

N. Variable Frequency Drives:
1. Adjust drive and perform "start-up" tests as recommended by manufacturer.
2. Establish proper direction of rotation for the motor controlled by the drive.
3. Verify that the drive will operate properly in the "manual speed" control mode or in the "automatic" mode from a remote speed signal input.
4. Set the maximum "locked rotor" current drawn during start-up as recommended by the manufacturer and approved by Engineer.
5. Set the minimum and maximum speeds and the acceleration and deceleration "ramps" as recommended by Engineer.
6. Operate the drive at 100% speed for at least 10 minutes and monitor output current. The output current should remain below the full load current listed on the motor nameplate. Check for excessive heating of the drive and motor. Report any discrepancies to Engineer.

O. Grounding Tests:
1. Measure resistance of ground system at each ground riser.
2. Test at least three of each type of ground connections and not less than 25% of all ground connections.
3. Test by one of the following methods for resistance measurement:
    a. Three-point method using an ammeter and voltmeter with ac or dc power supply.

P. Computer System Tests:

1. Uninterruptible Power System (UPS):
   a. Simulate a power failure with the operator stations and PLCs on-line and operating. Verify that the load is picked up without any "System Lockup." Verify the battery charging system is operating properly.
2. Programmable Logic Controller (PLC):
   a. Provide a complete functional check of the PLCs and all modules and peripherals to assure that each component and the PLC system operates properly and in accordance with the manufacturer's specifications.

Q. Infrared Temperature Survey:
1. After all testing is completed, terminations have been checked for proper torque, equipment has been re-energized, and two months after Substantial Completion, perform infrared testing as described.
2. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Infrared survey to include a normal color picture and a colorized infrared picture placed adjacent to each other (side-by-side, or one above the other) where one vantage point is shown per sheet in the compiled report.
4. Provide test and inspection equipment, supervision, and labor as required to perform infrared survey of the equipment listed in Part 1 of this specification after they have been re-energized and are in operation so correct operating temperatures can be recorded. Coordinate with Owner/Engineer, and where possible, wait to perform tests after equipment has successfully run at a minimum of 70% full load.
5. Furnish all labor to remove all covers, panel fronts, and other accessways to gain access to equipment or connections to be inspected. Perform infrared scan of joints and connections. After infrared survey is completed, reinstall all covers, panel fronts, and other items.
6. Infrared tests will include scanning all electrical connection points including terminal points and electrical contactors. In addition, transformers will be inspected for blocked radiators or any other localized heating.
7. Correct any deficiencies in cable terminations that resulted from improper re-tightening performed after equipment testing. Notify Owner/Engineer of any other issues encountered. A questionable area will be defined as an area where temperature is 10ºC greater than its surrounding area.
8. Report: Prepare certified report that identifies units checked and that describes scanning results. Include notation of questionable areas with a description of deficiencies detected, remedial actions taken, and scanning observations after remedial action.
9. Follow-up Infrared Scanning: Perform two follow-up infrared scans of equipment, one at four months and another at 11 months after Substantial Completion.

3.03 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 08 10

SECTION 26 22 13 – LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION specifies transformer work as indicated by Drawings and Schedules.
B. Types of transformers specified in this SECTION include the following:
   1. Dry-type transformers.
   2. Pad-mounted oil-filled transformers.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 00 00 - General Electrical Requirements
B. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems
C. SECTION 26 05 53 - Identification for Electrical Systems
D. SECTION 26 05 73 - Electrical Studies
E. SECTION 26 08 10 - Electrical Testing and Maintenance

1.04 REFERENCE STANDARDS:

A. ASTM International (ASTM):
   1. ASTM D877/D877M - Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids using Disk Electrodes.
   2. ASTM D923 - Standard Practice for Sampling Electrical Insulating Liquids.
B. Code of Federal Regulations (CFR):
   1. 10 CRF Part 429 - Certification, Compliance, and Enforcement for Consumer Products and Commercial and Industrial Equipment.
      a. 429.47 - Distribution Transformers.
   2. 10 CFR Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart K – Distribution Transformers.
      a. 431.193 - Test procedures for measuring energy consumption of distribution transformers.
      b. 431.196 - Energy Conservation Standards.
C. Institute of Electrical and Electronics Engineers (IEEE):
   1. IEEE C2 - National Electric Safety Code.
   2. IEEE C57.12.00 - General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
   3. IEEE C57.12.01 - General Requirements for Dry-Type Distribution and Power Transformers.
   4. IEEE C57.12.25 - Transformers Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with Separable Insulated High-Voltage Connectors; High Voltage, 34,500 GrdY/19,920 Volts and Below; Low Voltage, 240/120 Volts; 167 kVA and Smaller Requirements.
   5. IEEE C57.12.50 - Requirements for Ventilated Dry-Type Distribution Transformers 1 to 500 kVA, Single-Phase, and 15 to 500 kVA, Three-Phase with High-Voltage 601 to 34,500V, Low Voltage 120-600V.
   6. IEEE C57.12.91 - Test Code for Dry-Type Distribution and Power Transformers.

D. National Electrical Manufacturers Association (NEMA):
   1. NEMA ST 20 - Dry-type Transformers for General Applications.
   2. NEMA TR 1 - Transformers, Regulators, and Reactors. (Supplements IEEE C57 - Series Standards.)
   3. NEMA 250 - Enclosures for Electrical Equipment.

E. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC). Comply with NEC as applicable to installation and construction of electrical power/distribution transformers.

F. Underwriters Laboratories (UL):
   1. Comply with applicable requirements of UL 506 Safety Standard for Specialty Transformers. Provide transformers and components which are UL-listed and labeled.
   2. UL 1561 - Large General Purpose Transformers.

1.05 PERFORMANCE REQUIREMENTS:

A. Delegated Design: Design for seismic bracing and anchoring, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Seismic Performance: Equipment shall withstand the effects of earthquake motions. Refer to Structural design.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces or short circuit current specified and the unit will be fully operational after the seismic event."

C. Materials and Designation: Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittal.

B. Product Data: Submit for each type of product specified and included, with the following as a minimum:
   1. Technical product data: Includes, but not limited to, rated kVA, frequency, primary and secondary voltages, wiring diagram, percent taps, polarity, impedance and certification of transformer performance efficiency at 100% load, percentage voltage regulation at 100% load at 75ºC, full-load losses in watts, percent impedance at 75ºC, hot-spot and average temperature rise above 40ºC ambient temperature, sound level in decibels, and standard published data.

C. Shop Drawings: Submit the following as a minimum:
   1. Manufacturer's drawings indicating dimensions and weight loadings for transformers and wall brackets.
   2. Transformer nameplate data. Include center of gravity information in seismic zones.
   3. Wiring Diagrams: Submit wiring and control diagrams for transformers. Clearly differentiate between portions of wiring that are manufacturer factory installed and portions to be field installed.

D. Submit all field test data.

E. Closeout Submittals: Final documentation shall include:
   1. Operation and Maintenance manuals.
   2. Certified “As-Built” drawings.
   3. Copies of all approved Product Data.
   4. Copies of all approved Test Reports.

5. Warranty information.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

B. Transformers shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.

C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

D. Handle and prepare transformers for installation according to NEMA ST 20 and manufacturer's instructions.

1.08 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in PART 3.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

D. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Comply with IEEE C2, National Electric Safety Code.

G. Comply with IEEE C57.12.90, Test Code for Liquid-Immersed, Distribution, Power, and Regulating Transformers. or IEEE C57.12.91, Test Code for Dry-Type Distribution and Power Transformers.

H. Testing procedures shall comply with 10 CFR 429.47 - Distribution Transformers and 10 CFR 431.193 - Test procedures for measuring energy consumption of distribution transformers.

1.09 PROJECT SITE CONDITIONS:

A. Environmental Limitations:

1. Do not deliver or install transformers until spaces are enclosed and weather tight, any wet work is complete and dry, work above transformers is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

B. Service Conditions:

1. NEMA ST 20, usual service conditions.
2. Refer to Specification 26 00 00 for site conditions.

1.10 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

1.11 COORDINATION:

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in DIVISION 3.
B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the following (for each type of transformer):
   1. Eaton.
   2. ABB.
   3. Sola/Hevi-Duty, Emerson Electric Co.
   4. Siemens.
   5. Square D, Schneider Electric.

2.02 TRANSFORMERS:

A. General:
   1. Except as otherwise specified or indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.
   2. Comply with DOE energy efficiency standards as defined by 10 CFR Part 431.196 – Energy Conservation Standards for all transformers 15 kVA and larger.
   3. Core material shall be grain-oriented, non-aging silicon steel. Coils shall be continuous windings without splices except for taps. Internal coil connections shall be brazed or pressure type. Provide transformers that are constructed to withstand seismic forces specified by the Structural design.
   4. Enclosure ratings shall comply with NEMA 250 – Enclosures for Electrical Equipment.
B. Dry-Type Transformers (45 kVA or less):
   1. Factory-assembled and tested, general-purpose, air-cooled, dry-type transformers; of sizes, characteristics, and rated capacities indicated.
   2. Three-phase transformer: 480V delta connected primary and 208/120V wye-connected secondary with grounded neutral, 60-hertz, 10 kV BIL.
   3. Copper primary and secondary windings. Manufacturer’s standard impedance.
   4. Provide primary winding with 4 full-capacity taps; two 2-1/2% increments below and above full-rated voltage for de-energized tap-changing operation.
   5. Insulate with 220ºC, UL-component-recognized insulation system with a maximum of 115ºC rise above 40ºC ambient temperature.
   6. Rate transformer for continuous operation at rated kVA.
   7. Limit transformer surface temperature rise to maximum of 65ºC.

8. Provide terminal enclosure, with cover, to accommodate primary and secondary winding connections and raceway connectors.
9. Equip terminal leads with connectors installed. Limit terminal compartment temperature to 75ºC when transformer is operating continuously at rated load with ambient temperature of 40ºC. Provide wiring connectors suitable for copper wiring.
10. Cushion-mount transformers with external vibration isolation supports.
11. Sound-level ratings shall not exceed IEEE/NEMA standards. Conform to NEMA ST 20.
12. Electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap.
13. Provide transformers with ventilated or fully enclosed sheet steel enclosures. Apply manufacturer's standard light gray indoor enamel over cleaned and phosphatized steel enclosure.
14. All transformers shall be suitable for floor mounting unless noted otherwise.
15. Provide wall mounting brackets for wall- or column-mounted transformers.
16. Must comply with IEEE C57.12.01 and/or IEEE C57.12.50.
17. Must comply with UL 1561.

C. Final equipment selection: Review the short circuit equipment study. Provide only equipment that meets or exceeds the recommendation of that short circuit study specified in SECTION 26 05 73.

D. Equipment/System Identification: Provide equipment/system identification nameplates complying with SECTION 26 05 53.

E. Finishes: Coat interior and exterior surfaces of transformer, including bolted joints, with manufacturer's standard color baked-on enamel.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in SECTION 26 05 26.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NESC, NEMA, and IEEE standards in accordance with recognized industry practices to ensure that products fulfill requirements. Arrange equipment to provide adequate space for access and for cooling air circulation.

B. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.

C. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer. Wall brackets shall meet the environmental requirements of the transformer installation for each location.

1. Brace wall-mounting transformers per delegated seismic design.

D. Construct concrete bases and anchor floor-mounted transformers according to manufacturer's written instructions and seismic codes applicable to Project.

3.03 CONNECTIONS:

A. Provide equipment grounding connections for transformers as specified, indicated, and as required. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounding. Provide grounding in accordance with SECTION 26 05 26.

3.04 IDENTIFICATION:

A. Provide all warning signs, nameplates, labels and markers as specified in SECTION 26 05 53.
B. Label field-installed conductors, interconnecting wiring, and components.
C. Provide Equipment and conduit warning signs.
D. Provide Equipment nameplates.
E. Place arc flash label on equipment.

3.05 FIELD QUALITY CONTROL:

A. Tests and Inspections:
   1. Perform tests described below and per SECTION 26 08 10.
   2. Prior to energization of transformers, check all accessible connections for compliance with manufacturer's torque tightening specifications. Clean out any dust and dirt.
   3. Prior to energization, check circuitry for electrical continuity and for short circuits.
   4. Perform insulation resistance test: Megger between high-voltage winding to low-voltage winding, low-voltage winding to ground, and high-voltage winding to ground. Record and submit test results. If readings are below 50 megohms (at 77°F), notify Engineer before energizing transformer.
   5. Perform transformer turns ratio test (TTR) on the full winding and all taps. Record and submit test results.
   6. On liquid-filled transformers, perform insulating liquid dielectric test in accordance with ASTM D923 and ASTM D877.
   7. Check cooling fans and controls, where provided, for proper operation.
   8. Upon completion of installation of transformers and testing, energize primary circuitry at rated voltage and frequency from normal power source, and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the Site then retest to demonstrate compliance; otherwise, remove and replace with new units or components and proceed with retesting.
   9. Adjust transformer primary taps for nominal system voltage at initial installation and again when the transformer reaches its designed "full" load condition after occupancy by the Owner. Schedule all required electrical outages with the Owner.

3.06 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
   1. Touch Up:
      a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.

b. Field painting shall be performed based on manufacturer's recommended procedures.
c. Transformer manufacturer shall furnish Contractor with an adequate quantity of touch-up paint to match the factory applied finish.

3.07 ADJUSTING AND CLEANING:

A. Upon completion of installation, clean interior and exterior of transformers. Remove paint splatters, spots, dirt and debris.

3.08 PROTECTION:

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until unit is placed into service.

3.09 MAINTENANCE

A. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
B. Follow-up Infrared Scanning: Perform two follow-up infrared scans of equipment, one at four months and another at 11 months after Substantial Completion.
C. Instrument: Use infrared-scanning device designed to measure temperature or to detect significant deviations from normal values. Provide documentation of device calibration.
D. Report: Prepare certified report that identifies units checked and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

3.10 BASIS OF PAYMENT

A. See Section 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 22 13

SECTION 26 24 13 – SWITCHBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION specifies switchboard work that is indicated by drawings and schedules.
B. Types of switchboards specified in this SECTION include the following:
   1. Dead-Front Distribution:
      a. Circuit-breaker switchboards.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 00 00 - General Electrical Requirements
B. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems
C. SECTION 26 05 53 - Identification for Electrical Systems
D. SECTION 26 05 73 - Electrical Studies
E. SECTION 26 08 10 - Electrical Testing and Maintenance
F. SECTION 26 24 16 - Panelboards
G. SECTION 26 22 13 - Low Voltage Distribution Transformers
H. SECTION 26 32 13 - Engine Generator Sets
I. SECTION 26 43 13 - Surge Protective Devices
J. DIVISION 40 - Process Integration

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE):
   1. ANSI/IEEE C37.13 – Low-Voltage AC Power Circuit Breakers Used in Enclosures.
   2. ANSI/IEEE C37.14 – Low-Voltage DC Power Circuit Breakers Used in Enclosures.
   3. ANSI/IEEE C36.16 – Related Requirements and Application Recommendations for Low-Voltage Power Circuit Breakers and AC Power Protectors, Preferred Ratings.
C. Institute of Electrical and Electronic Engineers (IEEE):
   1. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings, Pertaining to Switchboards.
D. National Electrical Manufacturers' Association (NEMA):
   1. NEMA PB2 – Dead-Front Distribution Switchboards.
   2. NEMA PB 2.1 – General Instruction for Proper Handling, Installation, Operation, and Maintenance of Dead-Front Distribution Switchboards Rated 600V or Less.
   3. NEMA SG 3 – Low-Voltage Power Circuit Breakers.
E. National Fire Protection Association (NFPA): Comply with applicable local code requirements of the authority having jurisdiction and that portion of the NEC which pertains to installation and construction of switchboards.
   1. NFPA 70 – National Electrical Code (NEC).
   2. NFPA 70E – Standard for Electrical Safety in the Workplaces.
F. Underwriters Laboratories (UL) Compliance: Provide switchboards and components which are UL-listed and labeled.

1. UL 98 – Enclosed and Dead Front Switches.
2. UL 486A – Wire Connections and Soldering Lugs for Use in Copper Conductors.
3. UL 489 – Molded Case Circuit Breakers and Circuit Breaker Enclosures.
4. UL 891 – Dead Front Electrical Switchboards.
5. UL 977 – Fused Power Circuit Devices.
6. UL 1054 – Ground-Fault Sensing and Relaying Equipment.
7. UL 1449 – Surge Protective Devices.

G. Structural Engineering Institute/American Society of Civil Engineers (SEI/ASCE):
1. SEI/ASCE 7-2002 – Minimum Design Loads for Buildings and other Structures.

1.05 PERFORMANCE REQUIREMENTS:

A. Delegated Design: Design for seismic anchoring, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Seismic Performance: Equipment shall withstand the effects of earthquake motions. Refer to Structural design.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces or short circuit current specified and the unit will be fully operational after the seismic event."

C. Materials and Designation: Refer to Specification 26 00 00 for material service requirements, site conditions, environmental ratings & hazardous locations.

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.

B. Product Data: Submit for each type of product specified and included, with the following as minimum:
1. Data sheets for all components furnished as part of the equipment package. Indicate voltages, number of phases, frequency, short-circuit, and continuous current ratings.
2. Provide application data and time-current trip curves for main and branch circuit-breakers and fuses. Provide time-current curves for fuse melting and clearing.
3. Instrument transformer performance curves and data.

C. Shop Drawings: Provide the following as minimum:
1. Submit dimensioned drawings of switchboards showing accurately dimensioned equipment sections, including auxiliary compartments, section components, and combination sections.
2. Indicate shipping splits and weight of each section. Complete loading diagrams covering static and dynamic loadings for all conditions of operation and structural steel details. Provide center of gravity information for all seismic rated switchboards. Indicate all required access points for all terminations.
3. Wiring Diagrams: Submit a wiring diagram for the complete switchboard unit showing connections to electrical power feeders, distribution branches, and associated auxiliaries. All external power and control connections shall be clearly identified.
   a. Differentiate between portions of wiring that are manufacturer factory-installed and portions that are field-installed.
4. Nameplate schedule.
5. Surge Protective Device data and testing laboratory reports.
6. Coordination Study: As specified in SECTION 26 05 73.

7. Provide documentation on communication system interface along with a complete list of all available parameters and associated addresses.
8. Provide paper documentation of the programmable logic controller program.

D. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces at the site. Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assemble components or on calculation.
2. Dimensioned Outline Drawing of Equipment Unit: Identify center of gravity and locate describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Submit paint manufacturer's certification of VOC compliance and MSDS sheets. Submit certification of paint VOC level compliance as required by local or regional governing authorities.

F. Special Procedure Submittals:
1. Start-up and commissioning instructions.
2. Syllabus for Owner training.

G. Test and Evaluation Reports:
1. Qualification Data: For qualified Installer and Testing Agency.
2. Factory test reports.
3. Commissioning and Field test reports, including infrared scanning report.

H. Closeout Submittals: Final documentation shall include the following as minimum:
1. Operation and Maintenance Manuals including the following:
a. Operation and maintenance manuals for all components furnished.
b. Certified “As-Built” drawings of all equipment with information listed above.
c. Copies of all approved Product Data.
d. Copies of all approved Test Reports.
e. Spare parts and supply list with supplier names and part numbers.
f. Warranty Information.
g. Manufacturer’s service and repair support during and after warranty including contact information.
h. Training Materials. Includes final edited training videos.

I. Maintenance Material Submittals:
1. Spare Parts:
a. Three spare LED indicating lamps for each type and color used.
b. Three spare indicating light assemblies.
c. Three spare power and control fuses of each voltage and current rating used.
d. One 12oz aerosol cans of manufacturer’s touch-up paint for each color used. Color shall match the original factory applied color.
e. All parts supplied with the equipment shall be properly labeled for ease of identification and to permit the shortest possible time to repair.
2. Software:
a. Soft copy of PLC programs including all programming comments.
b. Organize and submit software on a USB flash drive.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

B. Deliver switchboards and components properly packaged and mounted on pallets or skids to facilitate handling of heavy items. Utilize factory-fabricated type containers or wrappings for switchboard and components which protect equipment from damage. Install impact measuring meters in containers which will indicate whether the container has been bumped or dropped. Return impact meters to the manufacturer for reuse upon delivery of switchboards. Inspect equipment to ensure that no damage has occurred during shipment.
C. All necessary hardware for reconnecting shipping splits shall be provided.
D. Store switchboard equipment in original packaging and protect from weather and construction traffic and according to the manufacturer's instructions. Store in a conditioned space to avoid condensation, dust, and other environmental contaminants. Do not store outdoors, wrapped or otherwise.
E. Handle switchboard equipment carefully to prevent physical damage to equipment and components. Remove packaging, including the opening of crates and containers, avoiding the use of excessive hammering and jarring which would damage the electrical equipment contained therein. Do not install damaged equipment; remove damaged equipment from the site and replace with new.

1.08 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least five years prior to Bid opening.
C. Factory Tests:
    1. The switchboard assembly shall be completely and functionally tested in the manufacturer's facility prior to shipment. For systems shipped in multiple sections, the switchboard shall be quality tested utilizing the plug-together wiring system which shall be unplugged prior to shipment and plugged together again when the equipment is installed in order to maintain the integrity of the manufacturer's quality assurance testing.
    2. Conduct tests on all system components and subassemblies to assure that all devices and systems are in proper working order before delivery to jobsite.
    3. Automatic Throw-Over System: Simulate actual system operation. Includes simulations of power failure, transfer to emergency source, and re-transfer to normal source.
    4. Submit test reports as specified in DIVISION 1.

1.09 SEQUENCING AND SCHEDULING:

A. Schedule delivery of switchboard equipment which permits ready building ingress for large equipment components to their designated installation spaces. Coordinate delivery of equipment with the installation of other building components.
B. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into concrete pad. Concrete, reinforcement, and formwork requirements are specified in DIVISION 3.

1.10 PROJECT SITE CONDITIONS:

A. Refer to SECTION 26 00 00 for Site Conditions.
B. Do not install the switchboard equipment specified herein until designated installation spaces are suitable for intended service.
C. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing the switchboard and shall be maintained for the remainder of the construction period.

1.11 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide switchboard units of one of the following (for each type, and rating of switchboard):
   1. Eaton Corporation.
   2. Siemens Corporation.
   3. Schneider Electric.

2.02 EQUIPMENT SECTIONS AND COMPONENTS:

A. General: Except as otherwise indicated, provide switchboards and ancillary components of types, sizes, characteristics, and ratings indicated which comply with manufacturer's standard design, materials, components, and construction, in accordance with published product information, and as required for complete installation. Provide terminals UL rated for 75ºC (minimum) conductors.
B. Final equipment selection: Review the short circuit equipment study. Provide only equipment that meets or exceeds the recommendation of that short circuit study specified in SECTION 26 05 73.
C. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
D. AC Dead-Front Distribution Switchboards:
   1. Factory-assembled, dead-front, metal-enclosed, self-supporting secondary power switchboards, of types, sizes, electrical ratings, and characteristics indicated.
   2. Assemblies consisting of vertical panel units and containing circuit-breakers assemblies of quantities, ratings, and types indicated.
   3. Provide switchboard with main bus rating as shown on the Drawings.
   4. Provide main bus with connections to switching devices and circuit-breaker branches of sufficient capacity to limit rated continuous current operating temperature rise to no greater than 65ºC above average ambient temperature of 30ºC.
   5. Main bus and tap connections shall be plated and bolted tightly according to manufacturer's torquing requirements for maximum conductivity.
   6. Copper bus current density shall not exceed 1,000 amperes per square inch.
   7. Brace bus for short-circuit stresses greater than or equal to the minimum interrupting capacity indicated.
   8. Provide accessibility of line and load terminations from front of switchboard. Rear access is not available.
   9. Provide equipment with built-in lifting eyes and yokes.
   10. Provide vertical individual panel units, suitable for bolting together at project site.
   11. Construct switchboard enclosures suitable for the following environment:
      a. Installation: Indoors, NEMA Type 12.
E. Enclosures: Construct dead-front switchboards suitable for floor mounting, with front cabling/wiring accessibility and conduit accessibility as indicated. Provide welded steel channel framework; hinge front wireway covers to permit ready access to branch circuit-

breaker load side terminals. Enclosure shall be suitable for being rolled or pushed into final location. Coat enclosures with manufacturer's standard corrosive-resistant finish.

F. Finish:
   1. Paint system with manufacturer's standard coating system suitable for intended service.
   2. Coating systems shall not contain any lead (0.00%), zinc or strontium chromates, mercury or mercury compounds, or asbestos. Coatings shall also be VOC compliant to meet the VOC level as required by the local or regional governing authorities. Equipment Manufacturers shall submit certification by coating manufacturers, including MSDS sheets, verifying these requirements.
   3. Exterior paint color shall be light gray.
   4. Provide factory-painted white mimic bus on front of each switchboard.

G. Circuit Breakers: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information and as required for a complete installation.
   1. Power Circuit Breakers (Mains and Ties):
      a. Shall be Draw-out low-voltage power circuit breakers.
      b. Frame ratings shall be as indicated on drawings.
      c. Breaker shall be 100% rated.
      d. Breaker shall be electrically operated.
      e. Breaker shall allow draw-out operation.
      f. Shall be provided with 120Vac motor operators.
      g. Control power for the circuit breaker shall be taken from a control power transformer internal to the switchboard assembly. Control power transformers shall be provided with primary and secondary fuse protection.
      h. The breaker control interface shall have color-coded visual indicators to indicate contact open or closed positions as well as mechanism charged and discharged positions. Manual control pushbuttons on the breaker face shall be provided for opening and closing the breaker. The power circuit breaker shall have a "Positive On" feature. The breaker flag will read "Closed" if the contacts are welded and the breaker is tripped or opened.
      i. Circuit breaker shall be furnished with minimum four (4) "a" contacts and four (4) "b" auxiliary contacts for remote indication of breaker open/close status. In addition, there shall be an overcurrent trip switch which consists of one (1) set of normally open and normally closed contacts for remote indication of breaker trip.
      j. Trip Units:
         (1) Each circuit breaker shall be equipped with a solid-state trip unit. The trip unit shall use microprocessor-based technology to provide advanced adjustable time-current protection functions.
         (2) Shall measure true rms current.
         (3) Trip unit shall signal the circuit breaker to trip actuators when predetermined trip levels and time delay settings are reached.
         (4) Interchangeable current sensors with their associated rating plug shall establish the continuous trip rating of each circuit breaker. The trip rating shall be indicated on the front of the trip unit.
         (5) The trip unit shall have an information system that provides LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A reset button shall be provided to turn off the LED indication after an automatic trip.

(6) Shall have a trip button to test the function of the trip unit in opening of the breaker.
(7) The trip unit shall be provided with a display panel, including a representation of the time/current curve that will indicate the protection functions. The unit shall be continuously self-checking and provide a visual indication that the internal circuitry is being monitored and is fully operational.
(8) The trip units shall be capable of the following protective functions.
(a) Adjustable long time pickup.
(b) Adjustable long time delay.
(c) Adjustable short time pickup.
(d) Adjustable short time delay.
(e) Adjustable instantaneous time pickup.
(f) Adjustable instantaneous time delay.
(g) Adjustable ground fault time pickup.
(h) Adjustable ground fault time delay.
(i) I^2t settings for instantaneous and ground fault.
(9) The trip unit shall be capable of basic power monitoring and metering functions. Metering functions shall include the following:
(a) AC Amps of each phase, accurate to ± 0.3%.
(b) AC Voltage, L-L and L-N, accurate to ± 0.3%.
(c) Real Power (Watts), accurate to ± 0.6%.
(d) Reactive Power (VAR), accurate to ± 0.6%.
(e) Apparent Power (VA), accurate to ± 0.6%.
(f) Power factor, accurate to ± 1%.
(g) Watt-hours meter, accurate to ± 0.6%.
(h) VAR-hours meter, accurate to ± 0.6%.
(i) VA-hours, accurate to ± 0.6%.
(j) Demand monitoring of current, watts, and VA with an adjustable time interval from 5 minutes up to 60 minutes.
(k) Frequency, accurate to ± 0.1 Hz.
(10) Provide Modbus communication interface to switchboard mounted automatic transfer controller PLC.

k. Provide necessary interlocks for automatic transfer control scheme as specified.

2. Molded-Case Circuit Breakers (Feeders):
a. Factory-assembled, molded-case, manually-operated.
b. Frame sizes and ampere rating as indicated, 600V, 60 Hz, 3 poles with RMS symmetrical interrupting ratings indicated.
c. Provide breakers with permanent thermal and instantaneous magnetic trips in each pole with fault-current limiting protection and ampere ratings as indicated.
d. Construct with overcenter, trip-free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle trip indication.
e. External handle clearly indicates when breaker is "ON," "OFF," or "TRIPPED," and lockable in the "OFF" position.
f. Provide push-to-trip button on enclosure cover for mechanical tripping circuit breakers.
g. Construct breakers for mounting in any physical position and operating in an ambient temperature of 40ºC.
h. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

i. Breaker Accessories: Provide the following molded-case breaker accessories:
(1) Auxiliary contacts.
(2) Alarm switch.
(3) Undervoltage trip.

3. Solid-State Trip Circuit Breakers:
a. Factory Assembled, Solid-state trip circuit breakers
b. Ampere rating indicated, 480V, 60 Hz, 3 poles, with RMS symmetrical ampere interrupting rating as indicated.
c. Construct breakers with ampere setting adjustment knobs for changing current carrying capability of units and with ground-fault protection components with external neutral current transformer (CT).
d. Provide electronic components for timing and monitoring internal currents and for initiating automatic tripping action.
e. Construct with trip-free mechanisms and with positive handle indication.
f. Provide push-to-trip button on cover for mechanical tripping circuit breakers.
g. Construct breakers for mounting in any physical position and operating in an ambient temperature of 40ºC.
h. Provide breakers with mechanical screw type removable connectors, AL/CU rated.
i. Solid-state trip circuit breakers shall have the following functions:
(1) Adjustable current, long time delay.
(2) Adjustable current, intermediate delay.
(3) Ground-Fault current pickup and delay.
(4) Adjustable current, instantaneous pickup.
(5) Short time current pickup and delay.

H. Where shown, provide an arc energy-reducing maintenance switch with a local status indicator for main circuit breakers with a rating of 1200A or greater to meet requirements of the NEC. Breakers may be identified on the Drawings with ARMS noted adjacent, or ALSIG (or a combination thereof).

I. Switchboard Bus: Provide switchboard busing with sufficient cross-sectional area to fulfill UL 891 pertaining to temperature rise. Buses shall be continuous rated as indicated on the drawings. Construct through-bus of copper (with silver-plated connections), with ampacity rating indicated, and with short-circuit current rating indicated. Provide fully rated main bus (tapered bus is not acceptable). Provide full capacity neutral bus when neutral bus is indicated. Provide ground bus full length of switchboard, firmly connected to each vertical section of the switchboard.

J. Metering and Protective Relays:
1. For Utility metering compartments shown, coordinate with local serving utility to provide compartments meeting Utility specifications.
2. For customer owned metering compartments, provide metering compartments, CTs, PTs, kWh meter, and instrument phase selector switches. Mount meters semi-recessed in front doors and install meter wiring and lacing with sufficient flexibility at hinged edge of meter front mounting plates to prevent damage. Provide the following metering devices where indicated.
a. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:
b. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.

(1) Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; bar type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
(2) Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
(3) Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

c. Digital Multi-function Meter (power monitor):
(1) Provide three-phase, multi-function, solid-state digital metering devices as indicated.
(2) Meter shall have an LED display and touch-pad that selects meter function, phase, minimum, maximum, and alarm mode of each meter function.
(3) Meter shall either be self-powered from voltage inputs or a control power transformer shall be provided to derive proper operating voltage.
(4) Meter shall accept 5 Amp current inputs.
(5) Meter shall accept 480 Vac inputs.
(6) Meter shall be capable of displaying and communicating the following parameters:
(a) AC Amps of each phase, accurate to +/- 0.3%.
(b) AC Voltage, phase-to-phase and phase to neutral, accurate to +/- 0.3%.
(c) Watts, accurate to ± 0.6%.
(d) Vars, accurate to ± 0.6%.
(e) VA, accurate to ± 0.6%.
(f) Power factor, accurate to ± 1%.
(g) Watt-hours meter, accurate to ± 0.6%.
(h) Var-hours meter, accurate to ± 0.6%.
(i) VA-hours, accurate to ± 0.6%.
(j) Demand monitoring of current, watts, and VA with an adjustable time interval up to 60 minutes.
(k) Frequency, accurate to ± 0.1 Hz.
(l) Percent of Total Harmonic Distortion accurate to the 31st harmonic.
(7) Shall be capable of communicating metered parameters over a Modbus TCP communication network.

K. Ground-Fault Protectors: Solid-state, ground-fault protection units for breakers rated 1000A and above of types and ratings indicated: equip with static relays, sensors, pilot lights, and push-buttons for fault indication, test, and reset; include fuse blocks, fuses, and control power transformers. Provide system which operates at 120Vac.
L. System Coordination: Provide settings for all adjustable trips such that the electrical system and switchboard devices are all selectively coordinated. Coordinate with SECTION 26 05 73.
M. Provide one of the manufacturer's standard solid-state trip programming and test devices to the Owner.

2.03 SURGE PROTECTIVE DEVICES (SPD):
A. Switchboard shall be provided with an integral Surge Protective Device (SPD) as specified in SECTION 26 43 13.

2.04 UTILITY METERING

A. Where required on the One-Line Drawings, provide vertical section and all necessary components meeting the requirements of the local electrical Utility company for utility metering. Coordinate with the local electrical Utility company for requirements.

2.05 PROCESS CONTROL SYSTEM (PCS) INTERFACE:

A. The switchboard system shall provide a network interface for the process control system (PCS).

B. The interface shall be designed such that the PCS or external user interface can in no way compromise the integrity or interfere with the critical operations of the Automatic Throw-over System.

C. The communications protocol to the PCS shall be via Modbus TCP.

1. A single Category 6 cable connection shall be used for this interface.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas and conditions under which switchboards and components are to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing the switchboard and shall be maintained for the remainder of the construction period.

3.02 INSTALLATION OF SWITCHBOARDS:

A. Install switchboards as indicated, in accordance with manufacturer's written instructions, and with recognized industry practices.

B. Comply with applicable requirements of NEC, NEMA PB 2.1, and NECA's "Standard of Installation." Provide seismic support and bracing to resist the forces of a Seismic event without damage.

C. Provide all openings in floors, walls, roofs, and other structures necessary for complete equipment installation, unless such openings are specifically indicated as being provided by others. Include openings through floors for future cables to connect to spare breakers and to spaces provided in equipment for future expansion.

D. Install a 3.5-inch high, nominal, concrete equipment pad 4 inches wider and 4 inches deeper than the switchboard.

E. Level, shim, and anchor to floor or wall with bolts or concrete anchors.

F. Install all necessary wiring or interconnections as required.

G. Make all internal and external connections as indicated and as required by manufacturer's wiring diagrams.

H. Check all internal and external connections, especially current transformer secondary short circuiting jumpers, and tighten as required.

I. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and the National Electrical Code.

J. Grounding:

1. Provide equipment grounding connections for switchboards as indicated. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

2. Test for ground continuity. Test neutral continuity to grounded point of derived system.

K. Place Dow Corning 3-6548 Silicone RTV or General Electric RTF762 sealant in the following locations:
1. All holes in concrete walls, floors and roof slabs after installation of conduit.
2. All unused holes and sleeves as approved by Engineer.

3.03 IDENTIFICATION:

A. Provide all warning signs, nameplates, labels and markers as specified in SECTION 26 05 53.
B. Label field-installed conductors, interconnecting wiring, and components;
C. Provide Equipment and conduit warning signs.
D. Provide Equipment nameplates.
E. Place arc flash label on equipment.
F. Create a directory to indicate installed circuit loads; incorporate equipment served and room designations as indicated on the Drawings. Use a computer printer to create directory; handwritten directories are not acceptable. Directory shall be subject to approval by the Engineer.
G. Provide each overcurrent device with a corresponding adhesive label with associated number and load served as indicated.

3.04 FIELD QUALITY CONTROL:

A. Manufacturer’s Field Services:
1. Manufacturer's field service shall be provided as specified in this SECTION and in DIVISION 1.
2. Switchboard manufacturer shall provide the field services of a factory technician for a minimum of 3 day(s) on 2 separate occasions to supervise/inspect installation, test and start-up all equipment provided. All travel and living expenses shall be included. All equipment required for testing, start-up and performance verification shall be provided by the start-up technician.
3. Additional days and trips shall be provided as required to fully complete field testing, startup, and training as specified.
4. The switchboard manufacturer shall provide a factory technician specializing in Modbus TCP communication as part of the start-up field services. All equipment required for setup and configuration shall be provided by the technician. The technician shall be available to assist the Systems Integrator in setup and configuration of the plant control system network connections to the switchboard and associated network connected devices.

B. Field Testing:
1. Perform tests described below and per SECTION 26 08 10.
2. Perform “start-up” tests as recommended by manufacturer.
3. Prior to energization of circuitry, check all accessible connections to manufacturer's torque tightening specifications.
4. Prior to energization, check for electrical continuity of circuits and for short-circuits.
5. Prior to energization check with an insulation resistance tester: phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled. Record and submit field test data.
6. Configure networked equipment for proper communication on the Modbus TCP PCS network.

7. Test network communication to all network connected electronic meters, trip units, and logic controllers and verify the overload device is responding to commands and reporting statuses properly to the plant control system.
8. The manufacturer's representative shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved Short-Circuit, Coordination and Arc-Flash Hazard Analysis Studies.
9. Infrared Scanning:
    a. Infrared Scanning of equipment: Two months after Substantial Completion, perform infrared scan of joints and connections. Remove covers so joints and connections are accessible to portable scanner. Take visible light photographs at same locations and orientations as infrared scans for documentation to ensure follow-on scans match same conditions for valid comparison.
    b. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Follow-up Infrared Scanning: Perform two follow-up infrared scans of equipment, one at four months and another at 11 months after Substantial Completion.
    d. Instrument: Use infrared-scanning device designed to measure temperature or to detect significant deviations from normal values. Provide documentation of device calibration.
    e. Report: Prepare certified report that identifies units checked and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

C. Additional Field Testing:
    1. Provide additional field testing as required by switchboard manufacturer.
D. Submit field testing and commissioning reports as specified in DIVISION 1.

3.05 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
    1. Touch Up:
        a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
        b. Field painting shall be performed based on manufacturer's recommended procedures.
        c. MCC manufacturer shall furnish Contractor with an adequate quantity of touch-up paint to match the factory applied finish.

3.06 ADJUSTING AND CLEANING:

A. Adjust operating mechanisms for free mechanical movement.
B. After field installation and final wiring terminations are completed the field connected power and control wiring and cables shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.
C. Prior to final acceptance the switchboard interior and exterior shall be wiped clean and free from dust and debris.

3.07 DEMONSTRATIONS:

A. Subsequent to installation of switchboard and all main, feeder, and branch circuit wire and cable hook-ups, energize switchboards and demonstrate functioning in accordance with requirements.
B. Demonstrate the automatic throw-over system in both automatic and manual mode.
C. Where necessary, correct malfunctioning units and then retest to demonstrate compliance.

3.08 TRAINING:

A. The switchboard manufacturer shall provide a qualified representative for a minimum of 1.5 (one and one half) day(s) of training at the customer's facility for operations, maintenance and service personnel.
    1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.
    2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, programming, setup, configuration, operational indicators, faults, diagnostic tools, troubleshooting, and preventive maintenance.
    3. Hands-on training shall be provided on the equipment.
    4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.
B. The Owner at their option shall be allowed to video record all training sessions for future reference.
C. Contractor shall record the training sessions and provide a final edited version to the Owner on electronic video file format.

3.09 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 24 13

SECTION 26 24 16 - PANELBOARDS

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION specifies panelboards and mini-power centers, including cabinets and boxes, as indicated by Drawings and Schedules, and as specified herein.

B. Types of panelboards and enclosures required for the Project include the following:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 00 00 - General Electrical Requirements
B. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems
C. SECTION 26 05 53 - Identification for Electrical Systems
D. SECTION 26 05 73 - Electrical Studies
E. SECTION 26 08 10 - Electrical Testing and Maintenance
F. SECTION 26 43 13 - Surge Protective Devices

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with the latest standards revision in effect as of the date of the Contract Documents unless otherwise indicated.

B. Code of Federal Regulations (CFR):

1. 10 CRF Part 429 – Certification, Compliance, and Enforcement for Consumer Products and Commercial and Industrial Equipment.
    a. 429.47 – Distribution Transformers.
2. 10 CFR Part 431 – Energy Efficiency program For Certain Commercial and Industrial Equipment, Subpart K – Distribution Transformers.
    a. 431.193 – Test procedures for measuring energy consumption of distribution transformers.
    b. 431.196 – Energy Conservation Standards.

C. Institute of Electrical and Electronic Engineers (IEEE):

1. IEEE C62.41.1 – Surge Environment in Low-Voltage (1000V and less) AC Power Circuits.
2. IEEE C62.41.2 – Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits.
3. IEEE C62.45 – Surge Testing on Equipment Connected to Low Voltage (1000V and less) AC Power Circuits.
4. IEEE C62.62 – Test Specification for Surge Protective Devices for Low Voltage AC Power Circuitry.

D. National Electrical Manufacturers Association (NEMA):

1. NEMA 250 – Enclosures for Electrical Equipment (1,000V Maximum).
2. NEMA PB 1 – Panelboards.
3. NEMA PB 1.1 – General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600V or Less.
4. NEMA PB 2.2 – Application Guide for Ground-Fault Protective Devices for Equipment.

5. NEMA ST 20 – Dry Type Transformers for General Applications.

E. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC): Comply with applicable local code requirements of the authority having jurisdiction and NEC as applicable to installation and construction of electrical panelboards and enclosures.

F. Underwriters Laboratories (UL): Provide panelboard units which are UL listed and labeled.
   1. UL 50 - Electrical Cabinets and Boxes.
   2. UL 67 - Electrical Panelboards.
   3. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   4. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures.
   5. UL 869A - Electrical Service Equipment.
   6. UL 1053 - Ground-Fault Sensing and Relaying Equipment.
   7. 1283 – Electromagnetic Interference Filters.
   8. 1449 – Safety for Surge Protective Devices.
   9. Special Use Markings: Provide panelboards constructed for special use with appropriate UL markings which indicate that they are "Suitable for Use as Service Equipment" where applicable.

G. Federal Specification (FS) Compliance: Comply with applicable requirements of the following standards.
   1. FS W-C-375 Series – Molded-Case Circuit-Breakers, Branch Service and Circuit.
   2. FS W-P-115C – Panel, Power Distribution.
   3. FS W-C-375 – Circuit Breakers, Molded Case; Branch Circuit and Service.

1.05 PERFORMANCE REQUIREMENTS:

A. Delegated Design: Design for seismic bracing and anchoring, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Seismic Performance: Equipment shall withstand the effects of earthquake motions. Refer to Structural design.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces or short circuit current specified and the unit will be fully operational after the seismic event."

C. Materials and Designation: Refer to Specification 26 00 00 for material service requirements, site conditions, environmental ratings & hazardous locations.

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.

B. Short Circuit study is to be submitted based on equipment intended to be provided. Study is to be approved prior to purchase orders for equipment being issued. Equipment where the specified short circuit current ratings are not sufficient shall be explicitly noted and recommendations shall be made to achieve selective coordination.

C. Submittals shall be custom prepared by the panelboard manufacturer for this specific application.

D. Product Data: Submit for each type of product specified and included, with the following as a minimum:
   1. Data sheets for all components furnished as part of the system package.

E. Shop Drawings: Provide the following as a minimum:

1. Panelboard dimensions and weight. Provide center-of-gravity information for each seismic rated panelboard.
2. Complete data on circuit breakers. Submit time - current characteristic curves of all devices.
3. Panelboard short-circuit interrupting capacity, and information on buses: Phase, neutral, and ground.
4. Information on whether panelboard is fed from top, bottom, or both.
5. Data on maximum and minimum incoming and outgoing feeder and branch circuit wire size.
6. Data on door, locks, and mounting: Surface or flush.
7. Data on total number of poles and number of unused poles that is available for future use.

F. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Operation and Maintenance Manuals including the following:
      a. Operation and maintenance manuals for all components furnished.
      b. Certified "As-Built" drawings of all equipment with information listed above.
      c. Copies of all approved Product Data.
      d. Copies of all approved Test Reports.
      e. Warranty Information.

G. Maintenance Material Submittals:
   1. Furnish extra materials and spare parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
      a. Keys: Two spares for each type of panelboard cabinet lock.
      b. Circuit Breakers, including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
      c. Provide a minimum of 3 spare breaker handle locking devices.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C700-7.13.

B. Panelboards shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.

C. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (Approximately 250 watts per panelboard for average conditions) to prevent condensation.

D. Handle and prepare panelboards for installation according to NEMA PB 1 and manufacturer's instructions.

E. Environmental Limitations:
   1. Do not deliver or install panelboards until spaces are enclosed, weathertight, dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.08 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

B. Testing Agency Qualifications: Member company of NETA or NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

C. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least one year prior to Bid opening.
D. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
E. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
G. Panelboards shall comply with NEMA PB 1.
H. Comply with NFPA 70.
I. Mini-power centers shall conform to the applicable requirements of 10 CFR 429.47 – Distribution Transformers and 10 CFR 431.193 – Test procedures for measuring energy consumption of distribution transformers.

1.09 COORDINATION:

A. Coordinate the layout and installation of panelboards and components with other types of equipment including raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in DIVISION 3.

1.10 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide panelboard and mini-power center products of one of the following (for each type and rating of panelboard and enclosure):
   1. Eaton.
   2. Siemens.
   3. Square D, Schneider Electric.

2.02 GENERAL REQUIREMENTS FOR PANELBOARDS:

A. Except as otherwise indicated, provide panelboards, enclosures, and ancillary components of types, size, and ratings indicated, which comply with manufacturer's standard materials and with the design and construction in accordance with published product information.
B. Where types, sizes, or ratings are not indicated, comply with NEC, UL, and established industry standards for those applications indicated.
C. Equip with proper number of panelboard switching and protective devices as required for complete installation.
D. Provide ground fault circuit interrupter type circuit breakers where indicated.

E. Enclosures: Flush- and surface-mounted cabinets as indicated.
   1. Provide enclosures fabricated by the same manufacturer as panelboards which mate and match properly with panelboards.
   2. Suitable ratings for environmental conditions at installed location. Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.
   3. Materials: Galvanized sheet steel cabinet type enclosures, in sizes required. Provide code gage (minimum 16-gage) thickness steel.
   4. Must be UL 50 listed.
   5. Front: Secured to box with adjustable, concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
   6. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Front doors shall have flush locks with three keys per panelboard, all panelboard enclosures keyed alike.
   7. Finishes:
      a. Color: Baked gray enamel finish over a rust inhibitor coating.
      b. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      c. Back Boxes: Galvanized steel. Stainless Steel for NEMA 4X panelboards.
      d. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
   8. Directory Card: Inside panelboard door, equip with interior circuit directory frame and removable card with clear plastic covering.

F. Phase, Neutral, and Ground Buses:
   1. Bus shall be braced to withstand available short-circuit currents as indicated.
   2. Provide suitable lugs on neutral bus for incoming and outgoing feeders requiring neutral connections.
   3. Equipment Ground Bus: Bare, uninsulated, adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
   4. Full-Capacity Neutral Bus and Lugs: Neutral bus and lugs rated 100% of phase bus and UL listed as suitable for nonlinear loads. Provide as indicated.
   5. Material: Tin-plated, Hard-drawn copper, 98% conductivity.

G. Conductor Connectors: Suitable for use with conductor material and sizes indicated and specified.
   1. Material: Hard-drawn copper, 98% conductivity.
   2. Main and Neutral Lugs: Mechanical type rated for AL/CU (aluminum/copper) conductors.
   3. Ground Lugs and Bus-Configured Terminators.
   4. Feed-Through Lugs: As indicated, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   5. All lugs shall be mechanical type.
   6. Provide terminals UL rated for 75ºC (minimum) conductors.

H. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

I. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals as indicated.

K. Final equipment selection: Review the short circuit equipment study. Provide only equipment that meets or exceeds the recommendation of that short circuit study specified in SECTION 26 05 73.
L. Surge Protection Devices: Provide an integral surge protection device for each panelboard as specified. Refer to SECTION 26 43 13 – Surge Protection Devices.
M. Provide panelboard nameplate as indicated.

2.03 POWER DISTRIBUTION PANELBOARDS:

A. Panelboards: NEMA PB 1, dead front, safety type, power and feeder distribution type, voltage and other ratings as indicated on the drawings.
B. Panelboard switching and protective devices in quantities, ratings, types, and with arrangements shown.
C. Anti-turn, solderless, pressure-type main lug connectors approved for use with copper conductors.
D. Where required, provide panelboards with UL markings which indicate "suitable for use as service entrance equipment". Shall meet UL 869A.
E. Incoming Mains Location: Top or bottom, as indicated.
F. Mains: Circuit breaker or lugs only, as indicated.
G. Branch Overcurrent Protective Devices:
    1. Bolt-on, molded-case circuit breakers.
    2. Molded-case circuit breakers shall have toggle handles that indicate when tripped.
    3. Where multiple pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously.
    4. Circuit breakers shall be replaceable without disturbing adjacent units.
H. Where necessary, furnish an integral metal locking device for each circuit breaker. Locking device shall be pad lockable and allow breakers to be individually locked in the OFF position.
I. Provide an integral surge protection device to protect the panelboard Refer to SECTION 26 43 13.
J. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
    1. For doors more than 36 inches high, provide two latches, keyed alike.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS AND LOAD CENTERS:

A. Panelboards: NEMA PB 1, dead front, safety type, power and feeder distribution type, voltage and other ratings as indicated on the drawings.
B. Lighting and appliance branch-circuit type as indicated with switching and protective devices in quantities, ratings, types, and arrangements shown.
C. Incoming Mains Location: Top or bottom, as required.
D. Mains: Circuit breaker or lugs only, as indicated.
E. Branch Overcurrent Protective Devices:
    1. Bolt-on, molded-case circuit breakers.
    2. Molded-case circuit breakers shall have toggle handles that indicate when tripped.
    3. Where multiple pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously.
    4. Circuit breakers shall be replaceable without disturbing adjacent units.
F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
G. Unless indicated otherwise on the Drawings, provide a minimum of 5-spare 20A and 3-spare 30A single pole breakers mounted within the panelboard.

H. Provide an integral surge protection device to protect the panelboard as specified in SECTION 26 43 13 – Surge Protection Devices.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
C. Verify Site conditions are suitable for installation of equipment.
D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the work.
E. Proceed with installation only after unsatisfactory conditions have been corrected.
F. INSTALLATION OF PANELBOARDS:
G. Install panelboards, mini-power centers, and enclosures as indicated, providing NEC required working space, in accordance with manufacturer's written instructions, applicable requirements of NEC and in compliance with recognized industry practices to ensure that products fulfill requirements. Where required, provide seismic support and bracing that shall resist the seismic forces event without damage.
H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.
I. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.
J. Provide properly wired electrical connections for panelboards within enclosures.
K. Install numbers on all circuit breakers and type the panelboard's circuit directory card upon completion of installation work. Clearly identify the load on each circuit and the circuit number according to the Contract Drawings.
L. Provide filler plates in all unused spaces.
M. Provision for future circuits at all flush mounted panelboards (unless indicated otherwise): Extend four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Extend four 1-inch conduits into raised floor space or below floor slab (not required for slabs on grade or basement floor slabs).

3.02 GROUNDING:

A. Provide equipment grounding connections for panelboard enclosures as indicated and as required by NEC. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds. Provide grounding as specified in SECTION 26 05 26.

3.03 IDENTIFICATION:

A. Provide all warning signs, nameplates, labels and markers as specified in SECTION 26 05 53.
B. Label field-installed conductors, interconnecting wiring, and components;
C. Provide Equipment and conduit warning signs.
D. Provide Equipment nameplates.
E. Create a directory to indicate installed circuit loads; incorporate equipment served and room designations as indicated on the Drawings. Use a computer printer to create directory;

handwritten directories are not acceptable. Directory shall be subject to approval by the Engineer.

3.04 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
C. Perform tests and inspections as specified and as recommended by the equipment manufacturer.
    1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
D. Acceptance Testing Preparation:
    1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
    2. Test continuity of each circuit.
E. Tests and Inspections:
    1. Perform tests described below and per SECTION 26 08 10.
    2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
    3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
    4. Prior to energization of electrical circuitry, check all accessible connections to manufacturer's tightening torque specifications.
    5. Prior to energization, check panelboard circuits for short circuits, electrical continuity of circuits, enclosure grounding and neutral grounding at service entrance and at incoming derived source transformer.
    6. Prior to energization of panelboards, check with insulation resistance tester the phase-to-phase and phase-to-ground insulation resistance levels of each phase bus to ensure requirements are fulfilled. Record and submit test results.
    7. Panelboards will be considered defective if they do not pass tests and inspections.
    8. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
    1. Touch Up:
        a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
        b. Field painting shall be performed based on manufacturer’s recommended procedures.
        c. Panelboard manufacturer shall furnish Contractor with an adequate quantity of touch-up paint to match the factory applied finish.

3.06 ADJUSTING AND CLEANING:

A. Once loads are finalized, Contractor to adjust panel circuiting to provide optimal load balancing.
B. Adjust moving parts and operable components to ensure normal function as recommended by manufacturer.
C. Upon completion of installation, clean interior and exterior of panelboards. Remove paint splatters, spots, dirt and debris.
D. Touch-up scratched or marred surfaces to match original finishes.
E. Adjust transformer taps of mini-power centers as required.

3.07 PROTECTION:

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.08 DEMONSTRATION:

A. Subsequent to final wire and cable hook-ups, energize panelboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

3.09 MAINTENANCE

A. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
B. Follow-up Infrared Scanning: Perform two follow-up infrared scans of equipment, one at four months and another at 11 months after Substantial Completion.
C. Instrument: Use infrared-scanning device designed to measure temperature or to detect significant deviations from normal values. Provide documentation of device calibration.
D. Report: Prepare certified report that identifies units checked and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

3.10 BASIS OF PAYMENT

A. See Section 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 24 16

SECTION 26 27 26 –WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION covers wiring devices for lighting and utilization equipment including but not limited to the following:
   1. Receptacles.
   2. Switches.
   3. Wall Plates.
   4. Plugs.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 05 26 – Grounding and Bonding for Electrical Systems.
B. SECTION 26 05 33 – Raceways, Boxes, Seals and Fittings for Electrical Systems.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. National Electrical Manufacturers Association (NEMA):
   1. NEMA WD 1 – General Color Requirements for Wiring Devices.
   2. NEMA WD 6 – Wiring Devices - Dimensional Specifications.
   3. NEMA 410 – Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.
C. National Fire Protection Association (NFPA):
   1. NFPA 70 – National Electrical Code (NEC).
D. Underwriters Laboratories (UL):
   1. UL 20 – General-Use Snap Switches.
   2. UL 486A-486B – Wire Connectors.
   3. UL 498 – Attachment Plugs and Receptacles.
   4. UL 514D – Cover Plates for Flush-Mounted Wiring Devices.
   5. UL 943 – Ground-Fault Circuit-Interrupters.
   6. UL 1310 – Class 2 Power Units.
   7. UL 1472 – Solid State Dimming Controls.
   8. UL 1682 – UL Standard for Safety Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type.
   9. UL 1686 – UL Standard for Safety Pin and Sleeve Configurations.
E. Federal Specification (Fed. Spec.):
   1. Fed. Spec. W-C-596 – Connector, Electrical, Power, General Specifications.
   2. Fed. Spec. W-S-896 – Switches, Toggles (Toggle and Lock), Flush-Mounted.

1.05 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Product Data for each product specified.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C700-7.13.
B. Wiring devices shall be packaged and shipped to the project site to avoid damage.
C. Store in a clean, dry space in original manufacturer's packing to avoid condensation, dust, and other environmental contaminants until ready for installation.

1.07 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. Conform to the requirements of NFPA 70.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this SECTION with minimum 3 years documented experience.

1.08 SEQUENCE AND SCHEDULING:

A. Schedule installation of wiring devices and associated wall plates after the surface upon which they are installed has received the final finish.

1.09 WARRANTY

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Appleton, Emerson Electric Co.
B. Cooper, Crouse-Hinds, Division of Eaton.
C. Hubbell, Inc.
D. Leviton Manufacturing Co., Inc.
E. Pass & Seymour, Legrand North America, Inc.
F. Russellstoll, Thomas & Betts.
G. Woodhead, Molex.
H. Source Limitation: Wiring device and associated wall plate shall be supplied from a single manufacturer for each type of device for consistency throughout project.

2.02 RECEPTACLES:

A. General:
    1. All receptacles shall be heavy-duty type and shall bear a UL 498 label and comply with NEMA WD 1 and WD 6 as applicable.
    2. Provide all necessary wiring and accessories as required for complete installation.
B. Flush-Mounted and Surface-Mounted Receptacles:
    1. Rated 20A at 125Vac.
    2. Duplex, arc-resistant, back and side-wired, 3-wire grounding type. NEMA reference 5-20R.
    3. Receptacle and wall plates shall be as follows:
        a. Flush mounted white receptacle and grade stainless steel wall plate with matching screws in finished areas.
        b. Surface-mounted receptacles shall be white and have cast copper-free aluminum FS or FD single or multiple gang boxes with stainless steel cover plate.

4. "Specification" grade type 5362, Fed. Spec. W-C-596 compliant, NEMA reference 5-20R.
5. When indicated provide GFCI type as specified in this SECTION.

C. Ground Fault Circuit Interrupter (GFCI) Receptacles:
1. Flush or surface mounted as indicated.
2. Rated 20A at 125Vac, Fed. Spec. W-C-596.
3. Back and side wired terminals with feed-through design.
   a. Terminal installation unless indicated otherwise.
4. UL Standard 943 Class A, Group 1.
5. Leakage current sensitivity: 5 mA ±1 mA.
   a. Opens circuit within 25 milliseconds of reaching 5 mA.
6. Duplex, arc resistant and prewired.
7. Cover plate materials and colors shall match standard receptacles as specified this SECTION.
8. FD box.

D. Weatherproof Receptacles:
1. Flush or surface mounted as indicated.
2. Rated 20A at 125Vac, Fed. Spec. W-C-596. NEMA reference 5-20R.
3. GFCI receptacle as specified in this SECTION, when indicated.
4. Provide a white receptacle with a cast aluminum weather-proof cover.
   a. Provide while in use cover for outdoor locations in addition to locations indicated.
   b. Provide hinged self-closing, gasketed type covers for indoor damp locations.
5. FS or FD boxes.
6. Locations as indicated.

2.03 SWITCHES:

A. General:
1. All switches and associated materials shall bear a UL 20 label and comply with NEMA WD 1.
2. Provide all necessary wiring and accessories as required for complete installation.

B. All single-pole, double-pole, three-way, and four-way switches as indicated.

C. Flush-Mounted, Tumbler, Self-Grounding, Heavy-Duty Switches:
1. Rated 20A at 120 or 277Vac.
2. Quiet type.
3. "Specification" grade, Fed. Spec. W-S-896.
4. White toggle and stainless-steel wall plate with matching screws.
5. Back and side wired design.
   a. Screw terminal installation unless indicated otherwise.
6. With grounding lug.

D. Surface-Mounted, Tumbler, Self-Grounding, Heavy-Duty Switches:
1. Rated 20A at 120V or 277Vac.
2. "Specification" grade (Fed. Spec. W-S-896) switch with gray toggle.
3. FS and FD single or multiple gang cast boxes.
4. Cast aluminum cover plates and matching countersunk screws.
5. Locations indicated.

E. Weatherproof, Self-Grounding, Heavy-Duty Switches:
1. Rated 20A at 120V or 277Vac.
2. Gray toggle.
3. Flush or surface mounted as indicated.

4. FS or FD boxes with PVC gasketing.
5. "Specification" grade. Fed. Spec. W-S-896.
6. Lever-type, cast aluminum, gasketed cover plate.
   a. Cooper, Crouse-Hinds No. DS185 or engineer approved equal.
7. Locations indicated.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General:
   1. Install wiring devices and accessories in accordance with manufacturer's written instructions, and in accordance with recognized industry practices.
   2. Coordinate with other work, including painting, electrical boxes, and wiring installation.
   3. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A-486B.
   4. Install wiring devices only in electrical boxes which are clean - free from building materials, dirt, and debris.
   5. Wiring devices shall not be installed in boxes until wire pulling is completed.
   6. Painting work shall be completed prior to device wall plate installation.

B. Receptacles:
   1. Provide in locations identified and as required by the NEC.
   2. Mount receptacles outlets 1'-6" (450 mm) above floor, walkways, or finished grade unless indicated otherwise.
   3. Provide GFCI receptacles in areas defined as damp or wet, and outdoor locations.

C. Switches:
   1. Mount 4 feet (1.2 meters) above floor, walkways, or finished grade unless indicated otherwise.
   2. Install close to trim on lock side when located near doors.

D. Wiring Circuits:
   1. Home Run Groupings:
      a. Group in home runs with not more than one conductor of each phase and 100% sized neutral and ground wire in one conduit.
      b. Circuits which are protected by ground fault circuit interrupter (GFCI) devices shall use their own separate and isolated neutral between the GFCI device and load.
   2. Use circuit numbers as indicated.
   3. Refer to Specification 26 05 19 Low Voltage Conductors and Cables for lighting and receptacle circuits, unless indicated otherwise.
   4. Do not install wire smaller than No. 12 AWG.
   5. Install larger size wire as indicated or required to conform to requirement of NFPA 70 (NEC).
   6. Install in concealed and exposed conduit systems as indicated.

3.02 PROTECTION:

A. Protect installed devices from damage.
B. Devices and wall plates that are damaged, stained, or painted shall be replaced prior to final acceptance.

3.03 FIELD QUALITY CONTROL:

A. Testing:

1. Prior to energizing circuits, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained.
2. After circuits are energized, test wiring devices and demonstrate compliance with requirements.
    a. Test each receptacle with a receptacle tester to ensure proper polarity.
    b. Test ground fault circuit interrupters with the local test button and with a receptacle tester to simulate a remote ground fault.

3.04 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 27 26

SECTION 26 28 16 –ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION specifies the enclosed switches or breakers including:
   1. Nonfusible switches
   2. Fusible switches

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 00 00 – General Electrical Requirements
B. SECTION 26 05 26 – Grounding and Bonding for Electrical Systems.
C. SECTION 26 05 33 – Raceways, Boxes, Seals, and Fittings for Electrical Systems.
D. SECTION 26 05 53 – Identification for Electrical Systems.
E. SECTION 26 05 73 – Electrical Studies
F. SECTION 26 08 10 - Electrical Testing and Maintenance

1.04 REFERENCE STANDARDS:

A. National Electrical Manufacturers Association (NEMA):
   1. NEMA 250 – Enclosures for Electrical Equipment (1,000V Maximum).
   2. NEMA KS 1 – Enclosed Switches.
B. National Fire Protection Association (NFPA):
   1. NFPA 70 – National Electrical Code (NEC): Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC Articles 200, 250, 430 and 702 as applicable to installation and construction of enclosed controllers.
C. Underwriters Laboratories (UL): Provide controllers and components which are UL-listed and labeled.
   1. UL 50 – Enclosures for Electrical Equipment.
   2. UL 50E – UL STANDARD FOR SAFETY Enclosures for Electrical Equipment, Environmental Considerations.
   3. UL 98 – Enclosed and Dead-Front Switches.
   4. UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   5. UL 508 – Electric Industrial Control Equipment.

1.05 PERFORMANCE REQUIREMENTS:

A. Delegated Design: Design for seismic bracing and anchoring, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Seismic Performance: Equipment shall withstand the effects of earthquake motions. Refer to Structural design.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces or short circuit current specified and the unit will be fully operational after the seismic event."
C. Materials and Designation: Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.

B. Short Circuit study is to be submitted based on equipment intended to be provided. Study is to be approved prior to purchase orders for equipment being issued. Equipment where the specified short circuit current ratings are not sufficient shall be explicitly noted and recommendations shall be made to achieve selective coordination.

C. Product Data:
   1. Submit manufacturer's data and installation instructions for each type of enclosed switch, disconnect, breaker, component, and accessories.
   2. Enclosure Details.
   3. Current and Voltage ratings.
   4. Short circuit ratings.
   5. Proof of any NTRL testing and certification of the equipment for the services as specified.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
   7. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF format.

D. Shop Drawings: Submit Shop Drawings showing dimensions and weights.
   1. Show tabulations of the following:
      a. Each installed unit's type and details.
      b. Factory-installed devices.
      c. Nameplate legends.
   2. Wiring Diagrams: Submit power and control schematic and wiring diagram. Differentiate between portions of wiring which are manufacturer factory installed and portions which are field-installed.
   3. Field quality-control reports.
   4. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

E. Closeout Submittals:
   1. Information listed above.
   2. Operation and Maintenance Data: Include the following as minimum:
      a. “As-Built” drawings.
      b. Field quality-control reports.
      c. Warranty information.
      d. Routine maintenance requirements for enclosed controllers and installed components.
      e. Manufacturer's written instructions for testing and adjusting circuit breaker trip settings.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

1.08 COORDINATION, SEQUENCING AND SCHEDULING:

A. Sequence equipment installation work with other work to minimize possibility of damage and soiling during remainder of construction period.

B. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.09 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

1.10 PERFORMANCE/DESIGN CRITERIA:

A. Materials and Designation: Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.

1.11 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.

B. Warranty shall include all parts, labor, and expenses to perform necessary work.

C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements,

1. Eaton.
2. ABB/General Electric.
3. Siemens.
4. Square D, Schneider Electric.

2.02 NONFUSIBLE SWITCHES

A. For use on circuits with available fault current less than 10kA.

B. For circuits with available fault current greater than 10kA, refer to paragraph FUSIBLE SWITCHES.

C. Type HD, Heavy Duty, Three Pole, Single Throw, 600 V(ac), 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Service-Rated Switches: Labeled for use as service equipment.
4. Hookstick Handle: Provide switches that allow use of hookstick to operate handle.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.03 FUSIBLE SWITCHES

A. For use as identified on the Drawings, or on circuits with available fault current greater than 10kA.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 600 V(ac), 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
   1. Provide with clips or bolt pads to accommodate required fuses.
   2. Provide required fuses per Electrical Studies.

C. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
   4. Service-Rated Switches: Labeled for use as service equipment.
   5. Hookstick Handle: Allows use of hookstick to operate handle.

2.04 ENCLOSURES:

A. Provide NEMA rated enclosures as required by the NEC or as indicated on the Drawings.

B. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, UL 50E, and UL 50, to comply with environmental conditions at installed location. Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.

C. Enclosure Finish: Enclosure must be:
   1. Gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (UL 50E Type 1).
   2. Gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (UL 50E Types 3R, 12).
   3. Brush finish on Type 304 stainless steel (UL 50E Type 4-4X stainless steel).
   4. Copper-free cast aluminum alloy (UL 50E Types 7, 9).

D. Conduit Entry: UL 50E Types 4, 4X, and 12 enclosures may not contain knockouts. UL 50E Types 7 and 9 enclosures must be provided with threaded conduit openings in both endwalls.

E. Operating Mechanism: Circuit-breaker operating handle must be externally operable with operating mechanism being integral part of box, not cover. Cover interlock mechanism must have externally operated override. Override may not permanently disable interlock mechanism, which must return to locked position once override is released. Tool used to override cover interlock mechanism must not be required to enter enclosure in order to override interlock.

F. Enclosures designated as UL 50E Type 4, 4X stainless steel, 12, or 12K must have dual cover interlock mechanism to prevent unintentional opening of enclosure cover when circuit breaker is ON and to prevent turning circuit breaker ON when enclosure cover is open.

G. UL 50E Type 7/9 enclosures must be furnished with breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Commencement of work will indicate Installer's acceptance of areas and conditions as satisfactory.

3.02 SELECTION OF ENCLOSURES

A. Refer to Specification 26 00 00 for material service requirements, environmental ratings & hazardous locations.

3.03 INSTALLATION

A. Comply with manufacturer's published instructions.
B. Special Techniques:
   1. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
   2. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
   3. Comply with mounting and anchoring requirements specified in SECTION 26 05 19.
   4. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
C. Provide required fuses per Electrical Studies.

3.04 IDENTIFICATION

A. Provide identification as specified in SECTION 26 05 53.
B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in SECTION 26 05 53.

3.05 FIELD QUALITY CONTROL

A. Perform tests described below and per SECTION 26 08 10.
B. Tests and Inspections for Switches:
   1. Visual and Mechanical Inspection:
      a. Inspect physical and mechanical condition.
      b. Inspect anchorage, alignment, grounding, and clearances.
      c. Verify that unit is clean.
      d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
      e. Verify that each fuse has adequate mechanical support and contact integrity.
      f. Inspect bolted electrical connections for high resistance using one of the following methods:
         (1) Use low-resistance ohmmeter.
            (a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
         (2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
            (a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.
      g. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on Drawings.
      h. Verify correct phase barrier installation.
      i. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:
    a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
    b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, use Table 100.1 from NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
    c. Perform ground fault test in accordance with NETA ATS Section 7.14 "Ground Fault Protection Systems, Low-Voltage."

C. Tests and Inspections for Molded-Case Circuit Breakers:
1. Visual and Mechanical Inspection:
    a. Verify that equipment nameplate data are as described in the Specifications and shown on Drawings.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, grounding, and clearances.
    d. Verify that unit is clean.
    e. Operate circuit breaker to ensure smooth operation.
    f. Inspect bolted electrical connections for high resistance using one of the following methods:
        (1) Use low-resistance ohmmeter.
            (a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
        (2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
            (a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.
    g. Inspect operating mechanism, contacts, and chutes in unsealed units.
    h. Perform adjustments for final protective device settings in accordance with coordination study.
2. Electrical Tests:
    a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
    b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, use Table 100.1 from NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

c. Perform contact/pole resistance test. Drop values may not exceed high level of manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
d. Perform insulation resistance tests on control wiring with respect to ground. Applied potential must be 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable. Test duration must be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values may be no less than 2 M Ω.
e. Determine the following by primary current injection:
(1) Long-time pickup and delay. Pickup values must be as specified. Trip characteristics may not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
(2) Short-time pickup and delay. Short-time pickup values must be as specified. Trip characteristics may not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
(3) Ground-fault pickup and time delay. Ground-fault pickup values must be as specified. Trip characteristics may not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
(4) Instantaneous pickup. Instantaneous pickup values must be as specified and within manufacturer's published tolerances.
f. Test functionality of trip unit by means of primary current injection. Pickup values and trip characteristics must be as specified and within manufacturer's published tolerances.
g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of shunt trip and close coils must be as indicated by manufacturer.
h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset trip logs and indicators. Investigate units that do not function as designed.
i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Test and adjust controls, remote monitoring, and safeties.

D. Nonconforming Work:
1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

E. Collect, assemble, and submit test and inspection reports.
1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.
4. Manufacturer Services:
5. On equipment rated 400A and higher, engage factory-authorized service representative to supervise and support field tests and inspections.

3.06 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as determined by the Electrical Studies provided under SECTION 26 05 73 – Electrical Studies.

3.07 PROTECTION

A. After installation, protect enclosed switches and circuit breakers from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.08 MAINTENANCE

A. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

B. Follow-up Infrared Scanning: Perform two follow-up infrared scans of equipment, one at four months and another at 11 months after Substantial Completion.

C. Instrument: Use infrared-scanning device designed to measure temperature or to detect significant deviations from normal values. Provide documentation of device calibration.

D. Report: Prepare certified report that identifies units checked and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

3.09 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 28 16

SECTION 26 29 00 –ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION specifies enclosures for motor controllers including:
   1. Contactors, push buttons, switches, indicating lights, relays, and additional motor controller and all necessary parts for a complete assembly.
   2. Network components mounted within the motor enclosure.

B. Coordination of motor horsepower, short circuit rating, VFD or starter size, including overload protection, as recommended by the final Short-Circuit, Coordination and Arc-Flash Hazard Analysis Studies.

1.03 RELATED REQUIREMENTS:

A. SECTION 26 00 00 - General Electrical Requirements
B. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems
C. SECTION 26 05 29 - Hangers and Supports for Electrical Systems
D. SECTION 26 05 33 - Raceways, Boxes, Seals, and Fittings for Electrical Systems
E. SECTION 26 05 53 - Identification for Electrical Systems
F. SECTION 26 05 73 - Electrical Studies
G. SECTION 26 08 10 - Electrical Testing and Maintenance
H. SECTION 26 29 23 - Variable-Frequency Motor Controllers
I. SECTION 40 05 93 - Common Motor Requirements for Water and Wastewater Equipment

1.04 REFERENCE STANDARDS:

A. National Electrical Manufacturers Association (NEMA):
   1. NEMA 250 – Enclosures for Electrical Equipment (1,000V Maximum).
   2. NEMA AB 1 – Molded-Case Circuit Breakers.
   3. NEMA ICS 1 – General Standards for Industrial Control Systems.
   4. NEMA ICS 2 – Industrial Control Devices, Controllers, and Assemblies.
   5. NEMA ICS 3 – Industrial Systems.
   6. NEMA ICS 6 – Enclosures for Industrial Controls and Systems.
   7. NEMA KS 1 – Enclosed Switches.

B. National Fire Protection Association (NFPA):
   1. NFPA 70 – National Electrical Code (NEC): Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC Articles 200, 250, 430 and 702 as applicable to installation and construction of enclosed controllers.

C. Underwriters Laboratories (UL): Provide controllers and components which are UL-listed and labeled.
   1. UL 50 – Enclosures for Electrical Equipment.
   2. UL 98 – Enclosed and Dead-Front Switches.
   3. UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   4. UL 489 – Molded Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
   5. UL 508 – Electric Industrial Control Equipment.

1.05 DEFINITIONS:

A. CPT: Control power transformer.
B. MCCB: Molded-case circuit breaker.
C. MCP: Motor circuit protector.
D. N.C.: Normally closed.
E. N.O.: Normally open.
F. OCPD: Overcurrent protective device.
G. SCR: Silicon-controlled rectifier.

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Short Circuit study is to be submitted based on equipment intended to be provided. Study is to be approved prior to purchase orders for equipment being issued. Equipment where the specified short circuit current ratings are not sufficient shall be explicitly noted and recommendations shall be made to achieve selective coordination.
C. Product Data: Submit manufacturer's data and installation instructions on motor controllers, contactors, push buttons, selector switches, indicating lights and relays.
D. Shop Drawings: Submit Shop Drawings of motor controllers showing dimensions and weights. Submit dimensional data on push buttons, selector switches, indicating lights and relays.
    1. Show tabulations of the following:
        a. Each installed unit's type and details.
        b. Factory-installed devices.
        c. Nameplate legends.
        d. Short-circuit current rating of integrated unit.
        e. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
E. Wiring Diagrams: Submit power and control schematic and wiring diagrams for motor controllers and contactors. Differentiate between portions of wiring which are manufacturer factory installed and portions which are field installed.
F. Field quality-control reports.
G. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.
H. Closeout Submittals:
    1. Information listed above.
    2. Operation and Maintenance Data: Include the following as minimum:
        a. “As-Built” drawings.
        b. Field quality-control reports.
        c. Warranty information.
        d. Routine maintenance requirements for enclosed controllers and installed components.
        e. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
        f. Manufacturer's written instructions for setting field-adjustable overload relays. Include installed and operating load current with list of settings.

g. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.
h. Infrared scanning report.

I. Maintenance Material Submittals:
1. Spare Parts:
a. One spare LED indicating lamps for each type and color used.
b. One spare indicating light assembly.
c. Ten spare power and control fuses of each voltage and current rating used.
2. All parts supplied with the equipment shall be properly labeled for ease of identification and to permit the shortest possible time to repair.

1.07 DELIVERY, STORAGE, AND HANDLING:
A. As specified in EJCDC C-700-7.13.
B. Deliver Equipment and components properly packaged in factory-fabricated type containers.
C. Store Equipment and components in original packaging and in a clean dry space; protect from weather and construction traffic.
D. Handle Equipment and components carefully to avoid breakage, impact, denting, and scoring of finishes. Do not install damaged Equipment; replace and return damaged units to Equipment manufacturer.

1.08 COORDINATION, SEQUENCING AND SCHEDULING:
A. Sequence equipment installation work with other work to minimize possibility of damage and soiling during remainder of construction period.
B. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.09 QUALITY ASSURANCE:
A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
C. Comply with NFPA 70.

1.10 WARRANTY
A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:
A. Subject to compliance with requirements, provide motor controllers, contactors, push buttons, switches, indicating lights, and relays of one of the following:
1. Allen-Bradley, Rockwell Automation, Inc.
2. Eaton.
3. Schneider Electric.
4. Siemens.

2.02 VARIABLE FREQUENCY DRIVES
- A. Refer to SECTION 26 29 23.

2.03 CIRCUIT BREAKERS:
- A. Rated 480V, 3-phase, 60-hertz, with RMS Symmetrical interrupting rating meeting the requirements of feeding equipment.
- B. External handle which clearly indicates when breaker is "ON," "OFF," or "TRIPPED" and is lockable in the "OFF" position.
- C. Molded-case, manually-operated, 3-pole.
- D. Trip-free from handle.
- E. Inverse time thermal element overload protection.
- F. Instantaneous magnetic short-circuit protection on all poles.
- G. Provide neutral and grounding lug kit.
- H. Shall comply with NEMA AB1 and UL 489.

2.04 ENCLOSURES:
- A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
- B. Unless otherwise indicated, provide enclosed controllers with the following NEMA enclosure ratings:
  1. NEMA 12 enclosures for interior finished areas and electrical rooms.
- C. Serviceability:
  1. Front Access: The VFD system shall be designed for front access only.
  2. Power Component Accessibility: All power components in the converter sections shall be designed for easy removal and accessibility to minimize repair downtime.
  3. Marking/Labeling: Sleeve-type wire marker tags or other acceptable means of permanent identification shall be applied to power and control wiring. Individual nameplates shall be provided for all major components of the VFD system.
- D. Equipment kAIC ratings to be provided as shown on the drawings.
- E. The maximum VFD enclosure size should not exceed 40”W X 35”D X 94”H as shown on the drawings.

2.05 SAFETY SWITCHES:
- A. Refer to SECTION 26 28 16.

PART 3 - EXECUTION

3.01 EXAMINATION:
- A. Verify site conditions are suitable for installation of equipment. Examine areas and surfaces to receive enclosed controllers, with Manufacturer Rep present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing enclosed controllers and shall be maintained for the remainder of the construction period.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall.

B. For controllers not at walls, provide freestanding racks complying with SECTION 26 05 33 – Raceways, Boxes, Seals, and Fittings for Electrical Systems.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Comply with NECA 1.

E. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 468A and the National Electrical Code.

3.03 IDENTIFICATION:

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in SECTION 26 05 53 – Identification for Electrical Systems.

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.04 GROUNDING:

A. Provide equipment grounding connections for motor controller and control equipment as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

B. Grounding shall conform to SECTION 26 05 26 – Grounding and Bonding for Electrical Systems.

3.05 FIELD QUALITY CONTROL:

A. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform tests described below and per SECTION 26 08 10.
2. Inspect controllers, wiring, components, connections, and equipment installation.
3. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
4. Test continuity of each circuit.
5. Check all equipment grounds for continuity.
6. Remove all blocking used for shipments.
7. Verify that voltages at controller locations are within ±10% of motor nameplate rated voltages. If outside this range for any motor, notify the Engineer before starting the motor(s).
8. Test each motor for proper phase rotation.

9. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace them with new units and retest.
10. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Enclosed controllers will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.06 ADJUSTING AND CLEANING:

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.
C. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.
D. Coordinate with SECTION 26 05 73 – Electrical Studies.

3.07 DEMONSTRATION:

A. Upon completion of installation of motor controller and control equipment and electrical circuitry, energize circuitry and demonstrate functioning of equipment in accordance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.
B. Engage a factory-authorized service representative to train Owner's maintenance personnel to use and reprogram microprocessor-based, reduced-voltage solid-state controllers.
C. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.08 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 29 00

SECTION 26 29 23 – VARIABLE FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION includes variable frequency drives (VFD) motor controller Work by this Contract.

B. Every variable frequency drive shall consist of all system components including the enclosures required to meet the performance, protection, safety, testing, and certification criteria of this specification.

C. The VFD system shall:

1. Represent a fully integrated package. Any components not manufactured by the VFD manufacturer shall be purchased by the VFD manufacturer and supplied with the VFD.
2. Include all material and labor necessary to interconnect any VFD system elements, even if shipped separately.

D. Any modifications to a standard product provided to meet this specification shall be performed by the VFD manufacturer only.

E. The VFD system shall be completely factory pre-wired, assembled and then tested as a complete package by the VFD manufacturer, to ensure a properly coordinated, fully integrated drive system.

F. Any third-party certification, safety or protection requirements shall be applied to the VFD system as a whole. Certification or protection of system elements or individual components by themselves is not acceptable.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 00 00 - General Electrical Requirements
B. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems
C. SECTION 26 05 29 - Hangers and Supports for Electrical Systems
D. SECTION 26 05 33 – Raceways, Boxes, Seals, and Fittings for Electrical Systems
E. SECTION 26 05 53 - Identification for Electrical Systems
F. SECTION 26 05 73 - Electrical Studies
G. SECTION 26 08 10 - Electrical Testing and Maintenance
H. SECTION 26 29 00 - Enclosed Controllers
I. SECTION 40 05 93 - Common Motor Requirements for Water and Wastewater Equipment

1.04 REFERENCE STANDARDS:

A. Provide equipment in full accordance with the latest applicable rules, regulations, and standards of:

1. American National Standards Institute (ANSI).
2. National Electrical Manufacturers Association (NEMA):
   a. NEMA MG1 – Motors and Generators.
3. Institute of Electrical and Electronics Engineers (IEEE).
   a. IEEE 519: Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.

B. National Fire Protection Association (NFPA):

1. NFPA 70 – National Electrical Code (NEC): Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC Articles 200, 250, 430 and 702 as applicable to installation and construction of enclosed controllers.

C. Underwriters Laboratories (UL): Provide controllers and components which are UL-listed and labeled.
1. UL 508 – Electric Industrial Control Equipment.
2. UL 60947-4-1, 3rd Ed. - Low-Voltage Switchgear and Control gear – Part 4-1: Contactors and Motor Starters – Electromechanical Contactors and Motor-Starters.

1.05 PERFORMANCE REQUIREMENTS:

A. Delegated Design: For stand-alone equipment, design for seismic bracing and anchoring, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements, design criteria indicated, and related product information for equipment to be supplied.

B. Seismic Performance: Equipment shall withstand the effects of earthquake motions. Refer to Structural design.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces or short circuit current specified and the unit will be fully operational after the seismic event."

C. Materials and Designation: Refer to Specification 26 00 00 for material service requirements, site conditions, environmental ratings & hazardous locations.

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.

B. Short Circuit study is to be submitted based on equipment intended to be provided. Study is to be approved prior to purchase orders for equipment being issued. Equipment where the specified short circuit current ratings are not sufficient shall be explicitly noted and recommendations shall be made to achieve selective coordination.

C. Product Data:
1. Product specification datasheets.
   a. Dimensions and weights.
   b. Current and Voltage ratings.
   c. Short circuit ratings.
   d. Proof of any NTRL testing and certification of the equipment for the services as specified.
   e. Detail features, characteristics, ratings, and factory settings.
2. Installation and operation instructions.

D. Shop Drawings: Submit Shop Drawings of motor controllers
1. Serial number.
2. Nameplate data.
3. Wiring Diagrams: Submit power and control schematic and wiring diagrams for motor controllers and contactors. Differentiate between portions of wiring which are manufacturer factory installed and portions which are field installed.
4. Factory Test Reports.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

B. Complete instructions for handling and storage shall be provided by the manufacturer prior to delivery of the equipment. All equipment shall have adequate provisions for handling by overhead crane or forklift truck.
C. Equipment shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.

1.08 QUALITY ASSURANCE:
A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. Factory Tests:
1. The manufacturer shall conduct tests according to industry standard requirements.
2. Perform factory tests on all VFD assemblies to assure that all devices and systems are in proper working order before delivery to jobsite.
3. Test all power, control and communication systems for proper operation.
4. Simulate actual system operation.
5. Submit test reports as specified in DIVISION 1.
C. VFDs shall be manufactured, assembled, tested and provided with an UL label.

1.09 WARRANTY:
A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:
A. Subject to compliance with requirements, provide VFDs of the following:
1. Allen-Bradley, Rockwell Automation, Inc.
2. Eaton.
3. Schneider Electric.
4. Siemens.

2.02 GENERAL:
A. Provide a Variable-frequency motor controller (VFD), consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of a three-phase induction motors by adjusting output voltage and frequency.
B. Capable of communication protocol and being controlled across the PCS network.
C. Motor Compatibility:
1. Motor life expectancy shall not be compromised in any way by operation with the VFD system. The VFD shall provide motor overload protection in any operating condition.
2. The VFD output waveform shall be suitable for operating a squirrel cage induction motor without derating or requiring additional service factor.
3. The system design shall not have any inherent output harmonic resonance in the operating speed range.
4. The VFD output shall not produce electrically induced, pulsating torque to the output shaft of the mechanical system eliminating the possibility of exciting a resonance caused by VFD induced torque pulsations.

5. The VFD shall protect the motor from high voltage dv/dt stress which would cause insulation breakdown of an "inverter ready" motor. When shown on the drawings, or if the VFD requires an output filter to meet this requirement, it shall be an integral part of the VFD system and be included within the VFD enclosure.
    a. As a minimum, an output filter shall be provided for motor lead lengths longer than 100 feet.
6. Provide VFDs with 5% DC choke or 3% line reactor.
7. Provide VFDs with motor output dV/dT filter.

D. Contactors are required to remove passive filters from the line when the VFD is not in service.
E. All protective devices and breakers as specified.
F. Designed for heat dissipation.
G. UL listed enclosure.
H. All soft communication interface equipment.
I. Any third-party certification, safety or protection requirements shall be applied to the Integrated Package as a whole. Certification or protection of only system elements or individual components by themselves is not acceptable.
J. The VFD system shall be delivered to the site preassembled and wired with all specified interconnecting wiring and cable.
K. Complete instructions for handling and storage shall be provided prior to delivery of the equipment. All equipment shall have adequate provisions for handling.
L. VFDs delivered before the installation location is prepared shall be stored according to the manufacturer’s instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.
M. VFD construction:
    1. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
    2. Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection for motors as specified in SECTION 46 05 93.
    3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
    4. Microprocessor based and utilized Pulse Width Modulation (PWM) for speed control of an induction motor.
    5. Insulated Gate Bipolar Transistors (IGBT’s).
    6. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
    7. Adjustable speed acceleration and current limits.
N. VFD Performance requirements:
    1. Power Factor: not less than 95% from 30 to 115% speed.
    2. Service factor: 1.15
    3. The VFD shall be capable of producing a variable AC voltage/frequency output to provide continuous operation of a standard induction motor over a 5-100% speed range with the following operational requirements:
        a. Output waveform shall be suitable for operating a squirrel cage induction motor without derating or requiring additional service factor.
        b. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFD input voltage rating.
        c. Input AC Voltage Unbalance: Not exceeding 5 percent.
        d. Input Frequency Tolerance: Plus or minus 3 percent of VFD frequency rating.
        e. Minimum Efficiency: 96 percent at 60 Hz, full load.

f. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.
g. Minimum Short-Circuit Current (Withstand) Rating: As required to match feeding equipment rating.
h. Ambient Temperature Rating: Not less than 32 deg F (0 deg C) and not exceeding 104 deg F (40 deg C).
i. Humidity Rating: Less than 95 percent (noncondensing).
j. Altitude Rating: as required by the Site Conditions.
k. Vibration Withstand: Comply with NEMA ICS 61800-2.
l. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
m. Speed Regulation: Plus, or minus 5 percent.

O. VFD & motor protection, include all controls necessary to indicate and alarm if a protection has tripped and which protection tripped:
1. Surge Suppression: Factory installed as an integral part of the VFD, complying with UL 1449 SPD, Type 1 or Type 2.
2. Surge Suppression: Field-mounted surge suppressors complying with SECTION 26 43 13 "Surge Protection for Low-Voltage Electrical Power Circuits," UL 1449 SPD, Type 2.
3. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
4. Under- and overvoltage trips.
5. Inverter overcurrent trips.
6. VFD and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFDs and motor thermal characteristics, and for providing VFD overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
7. Critical frequency rejection, with three selectable, adjustable dead bands.
8. Instantaneous line-to-line and line-to-ground overcurrent trips.
9. The VFD system shall be protected from damage due to the following, without requiring an output contactor:
a. Loss-of-power protection due to opening of the overcurrent protection device.
b. Loss-of-any-phase protection.
c. Reverse-phase protection.
d. Short-circuit protection.
e. Motor regeneration due to backspin or loss of VFD input power.
10. The VFD shall be able to withstand the following fault conditions without damage to the power circuit components:
a. Failure to connect a motor to the VFD output.
b. VFD output open circuit that may occur during operation.
11. Motor-overtemperature fault.
12. Control signals shall meet noise immunity and safety requirements as defined by IEEE 519.

P. Input Harmonics:
1. The harmonic mitigation devices shall limit the total harmonic voltage distortion at the point of common coupling to 5% and total demand (current) distortion (TDD) to the levels defined by the latest version of IEEE 519 with the following exception: The TDD shall not exceed the limits identified on the drawings even when higher limits are allowed.
2. The point of common coupling shall be defined as the bus servicing the feeder breaker to the harmonic mitigation device.

3. The VFD shall contribute less than 3% total harmonic distortion to the power distribution equipment.
4. Power factor shall be 0.98 lagging to 0.95 leading in the operating range of 50-100% load.
5. The harmonic mitigation device shall not introduce reactive power (kVAR) in excess of 15% of its kVA rating.

Q. VFD programmable settings:
1. The VFD shall include programmable I/O for application specific configuration.
2. The drive shall be configurable to operate in a local and remote mode.
3. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.
4. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
5. Bidirectional Autospeed Search: Capable of starting VFD into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
6. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
7. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
8. Integral Input Disconnecting Means and OCPD: UL 489, thermal-magnetic circuit breaker with pad-lockable, door-mounted handle mechanism. Rated not less than 115% of VFD current rating.
9. Fault log data shall be stored in nonvolatile memory.
10. A "FAULT LOG" shall record, store, and display upon demand, a minimum of the last four fault events.
11. The drive shall provide for the following programmable input/output points configured as indicated:
    a. Six digital inputs.
    b. Two digital outputs, Form C Relay (Dry Contract rated a minimum of 2 Amps at 120 Vac);
    c. One analog input 4-20 mA isolated signal.
    d. One analog output 4-20 mA isolated signal.
12. All programming shall initially be performed at the factory and tested at the factory. Specific requirements for the starting and stopping sequences shall be as indicated.
13. The VFD shall be capable of implementing a speed control PID loop to maintain a setpoint as indicated.
14. The VFD shall be provided with a communication card capable of communicating on a PCS network.
    a. All control functions including start/stop and speed control shall be available via the network.
15. All status and monitored input points shall be available via the network.

R. Sound Level: Maximum allowable audible noise from the VFD system will be 80 dBA at a distance of one meter (3.3 ft) at any speed or load condition. VFD systems with audible noise

in excess of this limit shall be provided with sufficient noise abatement treatment to reduce the sound pressure level below 80 dBA.

2.03 ENCLOSURES:

A. Refer to SECTION 26 29 00 for motor controllers installed in freestanding enclosures.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install to conform to manufacturer's instructions.

B. Completely install as specified, indicated, or required for operation and continuous service at the locations indicated.

3.02 FIELD QUALITY CONTROL:

A. Manufacturer’s Field Services:

1. Manufacturer's field service shall be provided as specified in this SECTION and in DIVISION 1.
2. Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
3. VFD system manufacturer shall provide the field services of a factory technician for a minimum of 2 day(s) on 2 separate occasions total of 4 day(s) and 2 trips to supervise/inspect installation, test and start-up all equipment provided. All travel and living expenses shall be included. All equipment required for testing, start-up and performance verification shall be provided by the start-up technician.
4. Assist the Owner in the setup and configuration of the motor controller on the SCADA or communications network.

B. Tests and Inspections:

1. Perform tests SECTION 26 08 10.

3.03 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 29 23

SECTION 26 32 13 – ENGINE GENERATOR SETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION shall consist of providing a packaged standby emergency generator set with resistive load bank, and associated controls with all required accessories as specified and shown on the plans. The equipment supplier must be the authorized distributor for each component of the products specified herein. The Work includes the furnishing of all labor, materials, equipment, test, and training to provide a complete and operational power system as shown on the plans, drawings, and specifications herein.

B. The power system shall be furnished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system.

C. The equipment shall be produced by a manufacturer who has produced this type of equipment for a period of at least five years and who maintains a service organization available twenty-four hours a day throughout the year.

D. The complete packaged electrical system shall meet all requirements of the State of Wyoming, city, and local codes, especially pertaining to emissions and fuel storage/delivery/ shutoff/monitoring systems.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. DIVISION 3 – Concrete

B. SECTION 26 08 10 - Electrical Testing and Maintenance

C. SECTION 26 24 16 – Panelboards.

D. SECTION 26 36 00 – Transfer Switches.

1.04 REFERENCE STANDARDS:

A. National Fire Protection Association (NFPA):

1. NFPA 30 – Flammable and Combustible Liquids.
2. NFPA 37 – Standard for the Installation and Use of Stationary combustion Engines and Gas Turbines.
3. NFPA 70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
4. NFPA 110 – Emergency and Standby Power Systems. (The generator set shall meet all requirements for Level 2 systems.)

B. Institute of Electrical and Electronic Engineers (IEEE):

1. IEEE 3003.1 – Recommended Practice for System Grounding of Industrial and Commercial Power Systems

C. Underwriters' Laboratories, Inc. (UL):

1. UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors.
2. UL 2200 – Stationary Engine Generator Assemblies.

D. National Electrical Manufacturers Association (NEMA):

1. NEMA MG 1 – Motors and Generators.
2. NEMA MG 2 – Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators.
3. NEMA 250 – Enclosures for Electrical Equipment (1000V Maximum)

E. Military Standards (MIL):
   1. MIL-STD-461F – Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment.
F. International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC):
   1. ISO 8528 part 4 – Control Systems for Generator Sets.

1.05 PERFORMANCE REQUIREMENTS:

A. Delegated Design: Design for seismic anchoring, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Seismic Performance: Equipment shall withstand the effects of earthquake motions. Refer to Structural design.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces or short circuit current specified and the unit will be fully operational after the seismic event."
C. Materials and Designation: Refer to Specification 26 00 00 for material service requirements, site conditions, environmental ratings & hazardous locations.
D. Generator Sizing – Load Steps
   1. Load Steps indicated for the generator set below shall be based on the pump motors and other building loads provided. Contractor to coordinate generator manufacturer and other vendors to ensure final generator sizing is adequate. Total generator load to not exceed 80% of the site rated capacity taking into account altitude, and ambient air conditions; max voltage dip not to exceed 10%, and max frequency dip not to exceed 5% on any of the project load steps. Generator size to be no smaller than indicated on the one-line diagrams.
   2. Coordinate load steps with System Integrator to ensure PLC programming does not attempt startup of equipment out of sequence.
   3. Pump Station
      a. Step 1
         (1) LP-001 & DP-001
      b. Step 2
         (1) Potable Water Pump 1 (P-001)
      c. Step 3
         (1) Potable Water Pump 2 (P-002)

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with Specification 01300 and EJCDC C-700.7.16 submittals.
B. Product Data: Submit for each type of product specified and included, with the following as minimum:
   1. Submit manufacturer’s data on engine-driven generator set and components.
   2. Manufacturer’s warranty.
   3. Submit application for Service Agreement with annual cost to Owner from Manufacturer for on-site service and maintenance (Owner may accept or decline such Service Agreement).
   4. Verification that complete packaged electrical system shall meet all requirements of the state, city, and local codes where the project is located.
C. Shop Drawings: Provide the following as minimum.

1. Submit dimensioned drawings indicating weights, combustion air requirements, cooling air requirements, heat rejection rate, fuel consumption, noise criteria, field connection points, and nameplate data.
2. Provide lifting requirements for setting equipment in place.
3. Submit wiring diagrams for all power and control interconnect wiring. Complete drawing and wiring diagrams including, but not limited to, showing coordination and connections between the following:
    a. Engine generator.
    b. Generator control panel.
    c. Automatic starting controls.
    d. Resistive load bank.
    e. All auxiliaries.
4. Certifications.

D. Factory Test Report, where required by this Specification.

E. Special Procedure Submittals:
1. Start-up and commissioning instructions.
2. Syllabus for Owner training.

F. Test and Evaluation Reports:
1. Provide generator test records of the following final production tests:
    a. Single step load pickup.
    b. Transient and steady-state governing.
    c. Safety shutdown device testing.
    d. Voltage regulation.
    e. Rated power.
    f. Maximum power.

G. Closeout Submittals: Final documentation shall include the following as minimum:
1. Operation and Maintenance Manuals including the following:
    a. Operation and maintenance manuals for the generator, engine, and all auxiliary components furnished.
    b. Certified “As-Built” drawings of all equipment and interconnecting diagrams.
    c. Copies of all approved Product Data.
    d. Copies of all approved Commissioning and Test Reports.
    e. Recommended preventive maintenance (PM) service and schedules.
    f. Spare parts and supply list with supplier names and part numbers.
    g. Warranty Information.
    h. Manufacturer’s service and repair support during and after warranty including contact information.
    i. Training Materials. Includes final edited training videos.

H. Maintenance Material Submittals:
1. Spare Parts:
    a. Two complete sets of oil, air and fuel filters.
    b. One quart of touch-up paint of each paint color used.
    c. Two spare sets of fuses of each type and rating.
    d. One set of special engine tools, if applicable.

1.07 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

B. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's standard design that has been in satisfactory use for at least one year prior to Bid opening.
C. Manufacturer must manufacture either the engine or the alternator.
D. Factory Tests of the generator shall include, but not limited to, the following:
   1. Maximum power (kW).
   2. Maximum motor starting (kVA) at 35% instantaneous voltage dip.
   3. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.40.
   4. Governor speed regulation under steady-state and transient conditions.
   5. Voltage regulation and generator transient response.
   6. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
   7. Three-phase short circuit tests.
   8. Alternator cooling air flow.
   9. Fuel consumption at 100%, 75%, 50%, and 25%.
   10. Overall engine-generator set efficiency.
   11. Torsional analysis to verify that the generator set is free of harmful torsional stresses.
E. Factory Tests of the load bank shall include, but not be limited to, the following:
   1. Maximum power usage (kW).
   2. Resistive load elements.
   3. Exhaust air flow.
   4. Operational.
F. The complete packaged electrical system shall be UL 2200 listed and shall be provided with UL listed components.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. Deliver the engine-driven generator and load bank properly packaged and mounted on skids to facilitate handling. Utilize factory-fabricated type containers or wrappings for protection of equipment.
B. Store natural gas engine-driven generator equipment in original packaging and protect from weather and construction traffic. Store indoors when possible; where necessary to store outdoors, store above grade and enclose with watertight wrapping.
C. Handle natural gas engine-driven generator equipment carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from site and replace damaged equipment with new.
D. Provide lifting information for setting gen-set in place to include lifting points, center-of-gravity, etc. Identify lifting items needed including crane capacity, spreader bars needed, special rigging, etc.

1.09 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. The manufacturer and its distributor of the packaged standby power system shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified.
C. Warranty shall include all parts, labor, and expenses to perform necessary work.
D. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

1.10 MAINTENANCE:

A. All maintenance materials supplied with the equipment shall be properly labeled for ease of identification and to permit the shortest possible time to repair.
B. Any parts that come from a sub-supplier shall be labeled with that manufacturer's name and part number.
C. Manufacturer shall state closest point where spare parts are stocked and where service can be obtained.
D. Manufacturer shall warrant that all parts shall be available for a minimum of ten years.
E. Maximum response time for trouble calls shall be two hours.
F. A qualified service technician shall be onsite within twenty-four hours of a qualified request.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Listing of Manufacturer and Model below does not indicate acceptance of equipment without Engineer approval of sizing calculations performed and provided by the manufacturer based on approved equipment submittals and load steps for Engineer review. Basis of Design size is used for indicating breaker sizes, conduit and wire sizes, dimensions on site plan for pad size, which may all vary based on final approved generator set to be supplied on the project.
B. Cummins
    1. 1000kW (Basis of Design)
        a. Model C1000N6B
            (1) Engine: QSK 60G
            (2) Excitation Type: Permanent Magnet
C. Caterpillar, Inc.
D. Kohler Power, Kohler Co.

2.02 EQUIPMENT:

A. Generator Set: The generator system shall be completely self-contained and integrally assembled, with the engine, generator, exciter, control panel, muffler, battery, battery charger, water jacket heater, main circuit breakers, 50% resistive load bank, service panel, convenience duplex GFCI receptacle, intake air cleaner, radiator and fan and all necessary parts shall be mounted on a steel skid on vibration isolator and shall be housed in a weather protective and sound attenuated enclosure. The complete packaged standby power system shall include the engine-generator set and other necessary parts for a complete functioning system. The generator system shall meet or exceed EPA tier emission levels based on its size and use.
B. Resistive Load Bank: The 50% resistive load bank system shall be installed within the generator enclosure with separate and isolated control and power components. The resistance load bank shall include self-contained load and control system tied into the generator controls enabling the load bank controls to modulate the load bank as the supplied load changes.
C. The engine generator enclosure shall be provided with anchors, supports and bracing that will meet the local seismic zone rating when installed per the manufacturer's instructions.

2.03 ENGINE:

A. General:
    1. Four-stroke cycle, direct-drive centrifugal cooled natural gas engine.
    2. Maximum operating speed of 1,800 rpm.
    3. Operate on natural gas.
    4. 24V dc starting.

5. Suitable for standby duty operation at nameplate rating.

B. Fuel System:
   1. Natural gas.

C. Muffler:
   1. The engine exhaust silencer shall be a critical-grade type with a tailpipe and rain cap provided. The silencer shall be coated to be temperature and rust resistant for outdoor application.
   2. Gas-proof, seamless, stainless steel, flexible exhaust bellows with threaded NPT or flange connection as necessary.
   3. Refer to weatherproof enclosure paragraph below for sound requirements of the complete package.

D. Battery and Battery Charger:
   1. 24Vdc lead-acid type storage battery, sized for ten cycles of 15-second cranking with engine at 0° ambient temperature.
   2. Filled with proper quantity of electrolyte and fully charged at time of installation.
   3. Battery system shall be provided with a disconnect switch.
   4. Battery rack and battery cables, capable of holding the manufacturer's recommended batteries, shall be supplied.
   5. Provide an automatic float and equalize battery charger with ±1% constant voltage regulation from no load to full load over ±10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambient temperatures from -40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected.
   6. Battery charger shall operate from 120Vac, 60-hertz supply from the generator service panel and shall be capable of fully charging batteries within 24 hours.
   7. The battery and battery charger shall be housed in the weather protective generator set enclosure.
   8. Battery charger shall be provided with a dry contact for common alarm for remote monitoring. The dry contact shall be rated for 3A at 120Vac operation and shall be wired to the generator control panel.
   9. Interlock preventing automatic restart attempts for the following shutdown conditions:
      a. Low lube oil pressure.
      b. High coolant temperature.
      c. Failure to start.

E. Cooling System:
   1. High-temperature, 50 Deg. C radiator.
   2. Thermostatically controlled water jacket heater for 208 - 120Vac operation to maintain 140°F minimum jacket water during idle periods.
   3. Extended life coolant shall be provided to completely fill the radiator tank at the installation site.
   4. Low coolant level alarm.
   5. Unit mounted radiator with guard and duct flange.
   6. Coolant drain line with valve.
   7. Fan and belt guards.

F. Air inlet:
   1. Air cleaner restriction indicator to indicate the need for maintenance.
   2. Heavy-duty single element canister type air cleaner.
   3. Air inlet louvers and baffles shall be designed to reduce rain and snow entry.

G. Lube:

1. Lubricating oil and filter.
2. Oil drain line with valves.
3. Lube oil pump, if required.

H. Governor:
1. Electronic isochronous type.

2.04 GENERATOR:

A. Alternator:
1. Full standby kW rating as indicated on the plans at 0.8 power factor.
2. 480/277 Vac wye, 3-phase, 4-wire, 60-hertz, 1,800-rpm operation.
3. Salient-pole, brushless, self-ventilated, drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform.
4. The insulation shall meet the NEMA standard for Class H.
5. Class F temperature rise of 105°C above 40°C ambient.
6. Winding and bearing temperature detectors to sense high temperature in windings and bearings.
7. Complete with a main circuit breaker, voltage regulation, control panel, and excitation system.
8. Provide segregated low voltage accessory boxes for AC/DC. Separate boxes for generator AC output, low voltage AC auxiliary power and control wiring, and DC wiring. Provide single point access to accessory connections.
9. Condensate strip heater to prevent the accumulation of moisture for dampness in the generator windings.
10. Harmonic distortion of less than 5%.
11. Overspeed capability of not less than 125%.

B. Excitation:
1. Permanent magnet.

C. Voltage Regulation:
1. Digital voltage regulator, 3-phase sensing, selectable voltage range, and volts/hertz.
2. Accuracy of less than 1% no-load to full-load and less than 0.5% at steady-state.

D. Main Circuit Breaker:
1. Insulated type, generator mounted.
2. Provide with microprocessor based digital unit with breaker rating as required by manufacturer. The digital trip unit shall have the following features: long-time pickup, long-time delay, short-time pickup, short-time delay, and ground fault alarm. Provide arc energy reduction for trip units rated larger than 1200A.
3. Provide breaker position and status contacts wired to the generator control panel for remote annunciation. Positions shall include the following:
   a. Closed.
   b. Open.
   c. Tripped.

E. Control Panel:
1. Environment:
   a. -40°C to +70°C operating temperature range.
   b. 5-95% humidity, non-condensing.
2. Unit mounted controller mounted on vibration isolators.
3. The controller shall be rated for outdoor installation.
4. Configured for 2-wire start/stop remote control (remote contact operation) from an automatic transfer scheme.

5. Control panel shall include as minimum:
   a. Automatic start/stop operation.
   b. Adjustable cycle cranking.
   c. Digital ac metering with phase selector switch.
   d. Digital engine monitoring.
   e. Shutdown sensors and alarms with horn and reset.
   f. Adjustable cool-down timer.
   g. Local emergency stop push-button.
   h. Lamp test.
   i. Voltage control.
6. Control panel shall include as minimum the following displays:
   a. Engine oil pressure.
   b. Coolant temperature.
   c. Engine rpm.
   d. System dc volts.
   e. Engine running hours.
   f. Generator ac volts.
   g. Generator ac amps.
   h. kW meter.
   i. Percentage of rated power.
   j. kVA meter.
   k. kVAR meter.
   l. Power factor meter.
   m. kWhr meter.
   n. Frequency.
7. Control panel shall provide the following indications for protection and diagnostics:
   a. Low oil pressure.
   b. High coolant temperature.
   c. Low coolant level.
   d. Overspeed.
   e. Overcrank.
   f. Emergency stop shutdown.
   g. Approaching high coolant temperature.
   h. Approaching low oil pressure.
   i. Low coolant temperature.
   j. Low dc voltage.
   k. Control switch not in Auto.
   l. Battery charger ac fail.
   m. High battery voltage.
   n. EPS supplying load.
   o. Spare.
8. Control panel shall have programmable protective relay functions to include the following:
   a. High and low battery voltage.
   b. Under- and over-voltage.
   c. Under- and over-frequency.
   d. Overspeed.
   e. Reverse power.
9. Adjustable Time Delay Settings:

a. Generator set run time (0 to 72 hours) - exercise.
b. Time delay for engine start. Adjustment range, 0-5 minutes in one second increments.
c. Time delay engine cool-down. Adjustment range, 0-10 minutes in one second increments.
d. Cyclic cranking that allows up to six crank cycles and up to 45 seconds of crank time per crank cycle.
e. Over and under voltage delays.
f. Crank on and crank pause time.
g. Idle time.
h. High and low battery voltage trip point.

10. Shall accommodate remote mounted emergency shutdown push button.
11. Provide generator run relay, common warning, and common failure relays.
    a. The common failure relay shall monitor auxiliary faults, emergency stop, high engine temperature, low oil pressure, overcrank, and overspeed.
    b. Dry output contacts from these relays will be used for remote alarm.
    c. The following minimum status contacts shall be provided and wired through the main generator control panel for field connection.
        (1) Generator Control Panel – In Auto Mode.
        (2) Run Status.
        (3) Common Warning Alarm.
        (4) Common Shutdown/Failure Alarm.
        (5) Generator Circuit Breaker Open.
        (6) Generator Circuit Breaker Closed.
        (7) Generator Circuit Breaker Tripped.
12. Provide a managed network switch to allow SCADA connection to the following:
    a. Engine control panel.
    b. The resistive load bank automatic load controller.

2.05 WEATHERPROOF ENCLOSURE:

A. The weatherproof walk-in style housing shall be as follows:
1. Sound attenuated with the maximum sound level of 70 dBA at 23 feet when operating at full load.
2. Constructed of heavy-gauge steel, cleaned and powder-baked painted inside and out. Provide with the manufacturer's standard color.
3. The complete exhaust system shall be internal to the enclosure.
4. The radiator shall be ducted to the enclosure air outlet on the top to prevent air recirculation within the enclosure.
5. The roof shall be pitched to prevent the accumulation of water.
6. Enclosure shall be designed for local wind and snow loading requirements.
7. The personnel doors shall be double-wide and located on either side of the enclosure.
8. All hinges, latches, and recessed door handles shall be stainless steel and lockable.
9. A permanent aluminum staircase with landing shall be provided at the main access door for ease of access into the generator enclosure.
10. Provide interior lights and receptacles wired to the service panel. Provide LED strip lighting fixtures for normal operation and emergency driver units installed within the LED strip fixtures for emergency lighting. Provide light switches at each door.
11. Provide enclosure ventilation with exhaust fan(s) and thermostats sized for ambient conditions to maintain internal temperature below component ratings.

12. Include grated, elevated platform for personnel entrance into the generator enclosure and platforms for operation and maintenance on both sides of the enclosure.

2.06 SERVICE PANEL:

A. Provide a 208/120Vac, single-phase, 100A, NEMA 3R electrical panel with the engine-generator set. The panel shall be unit mounted on the engine-generator set inside the weather protective sound attenuating enclosure. All auxiliary loads such as fuel immersion heater, water jacket heater, battery charger, generator condensate strip heater, convenience duplex GFCI receptacles, etc. The service panel shall be the means of single point connection to service all auxiliary loads mounted on the engine-generator set.
B. Shall consist of a 100A main molded-case circuit breaker, required number of branch circuit breakers, and 10% spare.
C. All wiring to the auxiliary loads shall be factory wired with copper wires and shall be sized and installed in accordance with the National Electrical Code.
D. The panel directory shall be provided and each load served shall be clearly marked on the panel directory.

2.07 AUTOMATIC TRANSFER CONTROLS:

A. The automatic transfer control system shall be as specified in SECTION 26 36 00 – Transfer Switches.

2.08 LOAD BANK:

A. The load bank shall be rated for 500kW, resistive, 1.0 power factor for continuous operation.
B. Rated for 480Vac, 3-phase, 60 Hz operation.
C. Rated for 120 deg. F maximum ambient air temperature.
D. Provide with 50kW resolution load steps with slide-out tray. Each load step shall be provided with individual branch circuit fuse protection.
E. Provide with self-contained automatic load and control system.
F. Provide with unpainted galvanized steel exhaust hood for vertical air displacement.
G. Provide with local control panel, including a digital load controller. The digital load controller shall be networked with the engine control panel via network switch to provide a single connection.
H. Load bank shall be installed in series after the radiator such that the radiator fan provides cooling air. Generator manufacturer and load bank manufacturer to coordinate as necessary to provide a fully-rated operational unit.
I. Except for test periods described under Part 3 of this specification, the load bank automatic load controller is to be programmed to load generator to no less than 30%, but no greater than 40%, adding and removing load as necessary.
J. Acceptable Manufacturer: Simplex, Neptune Model or approved equal.

2.09 ACCESSORIES:

A. Provide a NEMA 4X remote push button station with red mushroom head push button for generator emergency stop. The push button shall be provided with a legend "Genset Emergency Stop". Locate on generator exterior.
B. Required amount of lube oil for initial fill.
C. Required amount of coolant for initial fill.
D. Vibration isolators for base skid mounting.
E. One set of special engine tools, if applicable.

2.10 FACTORY TEST

A. For generator sets larger than 1000kW perform factory test. Provide certified test results.
B. A 4-hour load bank test shall be performed under resistive load at 100 percent of the standby kW rating of the system. Provide required fuel.
C. Factory Tests of the generator shall include, but not limited to, the following:
    1. Maximum power (kW). Utilizing the full capacity of the internal load bank. Supplement as required.
    2. Maximum motor starting (kVA) at 35% instantaneous voltage dip.
    3. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.40.
    4. Governor speed regulation under steady-state and transient conditions.
    5. Voltage regulation and generator transient response.
    6. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
    7. Three-phase short circuit tests.
    8. Alternator cooling air flow.
    9. Fuel consumption at 100%, 75%, and 50%.
    10. Overall engine-generator set efficiency.
    11. Torsional analysis to verify that the generator set is free of harmful torsional stresses.
D. Factory Tests of the load bank shall include, but not be limited to, the following:
    1. Maximum power usage (kW).
    2. Resistive load elements.
    3. Exhaust air flow.
    4. Operational.
E. Recorded generator operating parameters shall include:
    1. Line-to-line voltage.
    2. Line-to-neutral voltage.
    3. Power factor.
    4. Amperes.
    5. kW.
    6. kVA.
    7. Frequency.
    8. Phase rotation.
    9. Engine temperature.
    10. Oil pressure.
    11. Battery charge level.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment.
B. Examine areas and conditions under which the engine-generator equipment is to be installed. Direct the vertical airflow of exhaust hot air above level of personnel and away from buildings.
C. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install natural gas engine-driven generator units at location(s) indicated.
B. Install in accordance with the equipment manufacturer's written instructions, and with guidance from recognized industry practices, to ensure that engine-generator units fulfill requirements.

Comply with NFPA, NEC, and NEMA standards pertaining to installation of engine-generator sets and accessories.

C. Coordinate with other work, including raceways, electrical boxes, fittings, fuel tanks, piping, and accessories, as necessary to interface installation of engine-generator equipment work with other work.
D. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and the National Electrical Code.
E. Install as indicated on concrete pad as shown on the Drawings. Final pad dimensions shall be coordinated with equipment supplied.
F. Anchor skids as recommended by the generator set manufacturer.
G. Connect all electrical and fuel connections as required.
H. Install units on vibration isolators in accordance with the manufacturer's instructions.
I. Fill all tanks (coolant, lubricants, etc.) to full with approved fluids. Refer to Field Testing paragraph, in this Section, for all required fuel during start up.
J. Make all necessary adjustments to ensure manufacturer’s recommended tolerances are met.
K. Ground the skid base as shown on the drawings.
L. Supply field power to the generator service panel as specified and indicated. All skid mounted equipment shall be rated for a 208/120 power supply.

3.03 FIELD QUALITY CONTROL:

A. Manufacturer’s Field Services:
   1. Manufacturer's field service shall be provided as specified in this SECTION and in Division 01.
   2. Engage manufacturer’s service technician to perform start-up services upon completion of installation and with Engineer in attendance.
B. Field Testing:
   1. Perform tests described below and per SECTION 26 08 10.
   2. Check fuel, lubricating oil, and antifreeze for conformity to manufacturer’s recommendations under site environmental conditions.
   3. Verify operational status of engine water jacket heaters, battery charger, and other auxiliaries.
   4. Perform “start-up” tests as recommended by manufacturer.
   5. Check for exhaust leaks, path of exhaust gases outside the enclosure, cooling air flow, motorized louver operation, movement during starting and stopping and vibration during running.
   6. Recorded generator operating parameters shall include:
      a. Line-to-line voltage.
      b. Line-to-neutral voltage.
      c. Power factor.
      d. Amperes.
      e. kW.
      f. kVA.
      g. Frequency.
      h. Phase rotation.
      i. Engine temperature.
      j. Oil pressure.
      k. Battery charge level.

7. Verify generator is operational using the automatic transfer controls. Simulate power outage to verify proper start-up and transfer from normal utility power to generator power and retransfer from generator power to utility power.
8. After installation a 4-hour test shall be performed under facility load and supplemented with installed load bank as required to achieve 100 percent of the standby kW rating of the system.
9. Perform the engine generator acceptance testing as specified in NFPA 110 (7.13) and submit the final results of the acceptance testing to Engineer for review for compliance.
10. Provide all required fuel (coolant, lubricants, diesel, etc.) for start-up and testing. Refill the fuel tank to full level after the completion of start-up and testing.

3.04 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
   1. Touch Up:
      a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
      b. Field painting shall be performed based on manufacturer's recommended procedures.
      c. Manufacturer shall furnish Contractor with an adequate quantity of touch-up paint to match the factory applied finish.

3.05 TRAINING:

A. The system supplier shall provide a minimum of one day of training at the customer's facility for operations, maintenance and service personnel.
B. The training shall be performed after successful completion of a demonstration of operation of the equipment by the manufacturer and acceptance by the customer,
C. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, faults, diagnostic tools, troubleshooting, and preventive maintenance for engine-generator and battery systems.
D. Hands-on training shall be provided on equipment.
E. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.
F. The Owner at their option shall be allowed to video record all training sessions for future reference.
G. Contractor shall record the training sessions and provide a final edited version to the Owner on a DVD-ROM and electronic video file format.

3.06 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 32 13

SECTION 26 35 26 – HARMONIC FILTERS

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This Specification covers Active Harmonic Filters installed separately, and within other enclosures.

B. The manufacturer shall furnish, field commission and certify all installed AHF for satisfactory operation.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 00 00 - General Electrical Requirements
B. SECTION 26 05 19 - Low Voltage Conductors and Cable
C. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems
D. SECTION 26 05 53 - Electrical Identification
E. SECTION 26 05 73 - Electrical Studies
F. SECTION 26 08 10 - Electrical Testing and Maintenance
G. SECTION 26 24 13 - Switchboards

1.04 REFERENCE STANDARDS:

A. UL1449 – 4rd Edition (2014), C22.2 No. 233.1-87 (Surge withstand capacity)
B. CSA 22.2, No. 14 & 66
C. ANSI IEEE std 519-2014
D. UL 508
E. NEMA 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)
F. ASCE 7, "Minimum Design Loads for Buildings and Other Structures."
G. ICC IBC, "International Building Code."
H. ASTM E 329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction."
I. Electromagnetic Standard FCC 15j, Class A

1.05 DEFINITIONS:

A. AHF: Active Harmonic Filter
B. LED: Light Emitting Diode
C. TDD: Total Demand Distortion
D. THDi: Total Harmonic Distortion (current)
E. THDv: Total Harmonic Distortion (voltage)

1.06 PERFORMANCE REQUIREMENTS:

A. Refer to paragraph ACTIVE HARMONIC FILTER for harmonic filter performance requirements. Corrective amperage ratings shown on drawings are estimated based designed loads. Perform calculations based on final equipment sizing and submit for approval.

B. Delegated Design: Where units are mounted separately, design for seismic bracing and anchoring, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements, design criteria indicated, and related product information for equipment to be supplied.

C. Seismic Performance: Equipment shall withstand the effects of earthquake motions. Refer to Structural design.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces or short circuit current specified and the unit will be fully operational after the seismic event."

D. Materials and Designation: Refer to Specification 26 00 00 for material service requirements, site conditions, environmental ratings & hazardous locations.

E. Equipment manufacturer to calculate harmonics based on equipment provided and provide calculations for Engineer review and approval for sizing of active harmonic filter(s).

1.07 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.

B. Refer to each Section of this DIVISION for specific Product Data, Shop drawing and additional Submittal requirements.

C. Product Data: Submit for each type of product specified and included, with the following as minimum:
   1. Data sheets for all components furnished as part of the system package.

D. Shop Drawings: Provide the following as minimum.
   1. Fabrication and erection drawings.
   2. Equipment dimensions, shipping splits and shipping weights. The enclosure drawings shall include front, side, top, and bottom views of the enclosures with overall dimensions, and dimensioned conduit entrance locations.
   3. Equipment ratings.
   4. General outline drawing.
   5. Detailed equipment installation drawings.
   6. Schematic diagrams.
   7. Bill of materials.
   8. Nameplate schedule.
   9. Sizing calculations for active harmonic filters.
   10. Complete unit and internal wiring diagrams.
   11. External connection diagrams.
   12. Instrument transformer performance curves and data.

E. Special Procedure Submittals:
   1. Start-up and commissioning instructions.
   2. Syllabus for Owner training.

F. Test and Evaluation Reports:
   1. Factory acceptance test reports.
   2. Commissioning test reports.

G. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Operation and Maintenance Manuals including the following:
      a. Operation and maintenance manuals for all components furnished.
      b. Certified “As-Built” drawings of all equipment with information listed above.
      c. A certified report shall be provided to the owner of successful completion of performance tests.
      d. Copies of all approved Product Data.
      e. Copies of all approved Test Reports.
      f. Spare parts and supply list with supplier names and part numbers.
      g. Warranty Information.
      h. Manufacturer’s service and repair support during and after warranty including contact information.

i. Configuration sheet for each intelligent overload relay indicating as installed settings for each relay.
j. Training Materials. Includes final edited training videos.
k. Infrared scan report.

H. Maintenance Material Submittals:
1. Spare Parts:
a. Three spare LED indicating lamps for each type and color used.
b. Three spare indicating light assemblies.
c. Ten spare power and control fuses of each voltage and current rating used.
d. One 12oz aerosol cans of manufacturer's touch-up paint for each color used. Color shall match the original factory applied color.
e. All parts supplied with the equipment shall be properly labeled for ease of identification and to permit the shortest possible time to repair.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. As specified in SECTION 01 60 00.
B. The AHF manufacturer shall be responsible for labeling all external connections required at the project site.
C. Complete instructions for handling and storage shall be provided by the manufacturer prior to delivery of the equipment. All equipment shall have adequate provisions for handling by overhead crane or forklift truck.
D. AHFs shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.

1.09 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in PART 3.
C. Factory Tests:
1. The manufacturer shall conduct tests according to industry standard requirements.
2. Perform factory tests on all harmonic filter assemblies to assure that all devices and systems are in proper working order before delivery to jobsite.
3. Test all power, control and communication systems for proper operation.
4. Simulate actual system operation.
5. Submit test reports as specified in DIVISION 1.

1.10 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Equipment supplied across the site to be provided by one manufacturer.
   1. Allen Bradley
   2. Eaton
   3. Schneider
   4. Siemens
   5. Approved Equal

B. When included on the one-line diagrams as integral to a piece of equipment the harmonic filter shall be of the same manufacturer or shall be a standard offering in combination with the enclosing equipment.

2.02 GENERAL DESCRIPTION

A. All active harmonic filter shall be defined as a power electronic device consisting of power semiconductors known as insulated gate bipolar transistors (IGBT) that switch into the AC lines to modulate its output to mitigate detrimental harmonic current and correct the displaced reactive current for the power source. A DC bus shall store power for power semiconductor switching. A microprocessor shall control the operation of the power converter. The converter design shall be a three-level design to optimize performance and minimize heat losses. AHF shall be packaged with an autotransformer at rated mains voltage above 480 VAC.

2.03 CONSTRUCTION

A. Separately mounted units shall be mounted in minimum NEMA Type 1-gasketed or Type 12 enclosure. Enclosures shall be freestanding with provisions for top and bottom entry of cables.

B. Refer to Specification 26 42 19 for direct installations within motor control centers, not freestanding.

2.04 ACTIVE HARMONIC FILTER

A. The point of common coupling shall be defined as the line side of the bus servicing the feeder breaker to the harmonic mitigation device.

B. Ratings and Application Requirements
   1. TDD and THDv performance shall be limited as shown on the drawings.
   2. Displacement power factor (PF) shall be corrected to 0.95 or better at the location of each AHF.
   3. All nonlinear loads shall have DC choke included that are rated 5% or higher impedance.
   4. AHF shall be designed to operate continuously in an environment of 0 Deg to 40 Deg C ambient temperatures.
   5. Storage conditions shall have a temperature range of -40 Deg to 65 Deg C and be clean and dry.
   6. AHF shall withstand a relative humidity of not more than 95%, non-condensing.
   7. AHF shall be fully rated at a maximum altitude of 1000 meters (3300 feet). Above 1000 meters, a derating factor of 1% per 100 meters shall apply.
   8. AHF shall not exceed an audible noise level of 80 decibels at one meter from enclosure.
   9. System environmental conditioning requirement shall not exceed 7100W at 480V.
   10. AHF shall be designed to operate from an input voltage of 380 to 480 VAC, plus 10% minus 15%.
   11. AHF shall be designed to operate with a voltage frequency of 50 or 60 Hertz + / - 3 Hertz.

12. AHF shall be phase rotation insensitive. AHF shall detect phase rotation and align output accordingly.
13. AHF heat losses defined as maximum kW loss divided by maximum kvar output shall not exceed more than 5% at 480V.
14. AHF shall be UL listed according to UL508 and CSA listed according to CSA 22.2, No. 14 & 66.
15. AHF floor mount units shall include a door-interlocked circuit breaker rated at a minimum 100 kAIC (UL rated) up to 600 VAC.
16. AHF shall be designed with a current limiting function to protect the IGBT's.
    a. When the current limit level is attained, a message shall be displayed indicating the output capacity is at-maximum capacity and actuate the at-maximum capacity relay.
    b. Operation shall continue indefinitely at this level without trip or degradation of AHF.
17. AHF shall have automatic restart capability upon power loss return and fault resets.
    a. Fault trip limit shall occur after 5 restarts within a 5-minute period.
    b. Automatic restart shall occur for the following faults and may include other faults: AC line over voltage, AC line under-voltage, AC line power loss, and AC line phase imbalance, over temperature, under temperature, and DC bus over voltage.
18. Upon occurrence the fault trip limit, AHF shall stop output current production and lock out restart until the fault is manually cleared.
19. AHF shall incorporate an over-temperature output roll back that reduces the total output current to reduce power component heating to maintain maximum current correction within the electrical system.
20. AHF shall incorporate protective shutdown when air inlet temperature reaches 51° C.
21. AHF shall be designed to operate from an input voltage of 380 to 480 VAC or 600 VAC to 690 VAC, plus 10% minus 15%.
22. AHF shall be designed to operate with a voltage frequency of 50 or 60 Hertz + / - 3 Hertz.

C. Graphic Display Terminal
1. AHF shall have a door mounted human machine interface (HMI) with touch screen control rated NEMA 4- 12 (IP65), dust tight and liquid resistant.
2. HMI shall provide run/stop control from every screen.
3. HMI shall provide an oscilloscope feature to display specific parameters.
    a. HMI shall display the mains voltage and current waveforms.
    b. Performance trend information shall be displayed for load total rms current, load rms harmonic current per phase, AHF output harmonic current per phase, AC mains voltage per phase, THDi, TDD, THDv, load rms reactive current, and AHF output rms reactive current.
    c. Bar graphs shall be provided for display of the mains and load harmonic current amplitudes per harmonic order.
    d. Selected internal waveforms shall be provided for diagnostic and performance checks.
    e. All parameter adjustments shall be made via HMI and are password protected.
    f. HMI shall record and display an event log with time and date stamp. Event log shall be cleared manually by the user. A minimum of 100 events shall be stored.
4. HMI shall provide external communications via an RJ-45 connector.
    a. Provide network connection to monitor remote run/stop and display of all operating parameters, set up parameters and diagnostic functions.

b. Plant network utilizes ProfiNet for communications protocol. Provide converter or gateway as required.

5. HMI shall have a safety feature that locks out all other forms of control during service and commissioning.
   a. HMI must relinquish control to any other method of control.
6. HMI shall display a flashing warning screen in the event of a fault with full fault description. Error codes alone shall not be acceptable.
7. HMI shall be capable of downloading all pertinent parameters to an externally accessible USB memory device to permit remote diagnostic evaluations and to save unit set up parameters.
8. HMI shall include an on-board Commissioning Guide with automatic detection features.
   a. AHF shall automatically check and indicate AC line phase rotation.
   b. AHF shall automatically test for current transformers (CT) phase rotation and polarity. If installation is incorrect AHF shall compensate for phase rotation and orientation of CT's. If proper alignment cannot be achieved, a fault warning and lock out of operation shall occur.
   c. AHF shall automatically calibrate the CT for optimum harmonic cancellation performance.
   d. AHF shall perform a system integrity test at full capacity for a period of 15 minutes to validate installation.
   e. In the event any of the above cannot be reconciled, HMI shall lock out AHF function until commissioning agent corrects, verifies and clears each issue.

D. Function of AHF
1. AHF shall monitor the load current utilizing two current transformers (CT's) mounted on the AC lines for three phase loads. If phase to neutral loads are connected on a 4-wire system, three CT's are required.
   a. AHF shall analyze the content of the load current for harmonics from the 2nd to the 51st harmonic and determine the reactive current content representing displacement power factor.
   b. AHF shall be field selectable to operate as a harmonic filter or provide power factor correction or both.
   c. AHF shall be capable of open loop or closed loop operation.
2. AHF amperage output ratings shall be one of the following:
   a. A minimum of 60, 120, 200, or 300 amps from 380 to 480 VAC, or as shown on the drawings.
3. AHF shall provide for load balancing of AC lines current for harmonic and reactive currents regardless of actual load distribution per phase.
4. Up to 10 AHF of any size may be installed in parallel to inject current according to the information received from one set of mains CT's. Each unit shall be field selectable for operation as master or slave. If one unit is offline for maintenance or faulted, the remaining units shall automatically adjust the total output to make up for the offline unit(s).
   a. AHF that require dedicated master and slave units or power connections between unit DC buses shall not be acceptable.
   b. AHF that turn off all units when one is taken offline are not acceptable.
5. AHF shall have a NO (normally open) dry contact as secondary run/stop function.

E. Current Transformer
1. Current transformers shall be installed as defined by design engineer documentation.

2. A minimum of two current transformers per AHF location are required and mounted on phases A & B of the mains. If phase to neutral loads are connected on a 4-wire system, three CT's are required.
3. Current ratings of the current transformers shall be according to full load current rating of the circuit on which installed.
4. The secondary current rating shall be 5 amperes.
5. Current transformers rated for 50 to 400 Hertz shall be used.
6. 1% or better (metering class) accuracy shall be provided.
7. Current transformers shall be dedicated for AHF operation and not shared with other system components.

2.05 IDENTIFICATION:

A. Provide all warning signs, nameplates, labels and markers as specified in Section 26 05 53.
B. Label field-installed conductors, interconnecting wiring, and components;
C. Provide Equipment and conduit warning signs.
D. Provide Equipment nameplates.
E. Place arc flash label on equipment. Refer to Sections 26 05 73.
F. Create a directory to indicate installed circuit loads; incorporate equipment served and room designations as indicated on the Drawings. Use a computer printer to create directory; handwritten directories are not acceptable. Directory shall be subject to approval by the Engineer and Owner.
G. Provide each overcurrent device with a corresponding adhesive label with associated number and load served as indicated.
H. Refer to Section 26 05 53 for additional labeling information.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment.
B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing AHFs and shall be maintained for the remainder of the construction period.

3.02 INSTALLATION:

A. Install shall conform to manufacturer's instructions.
B. Where necessary, meet requirements of seismic anchoring design.
C. Completely install as specified, indicated, or required for operation and continuous service at the locations indicated.
D. For freestanding enclosures install a 3.5-inch-high concrete equipment (housekeeping) pad 3-inches wider and 3-inches deeper than the AHF. Clear dimension to anchor bolts to be a minimum of 4-inches.
E. Level, shim, and anchor to floor or wall with bolts or concrete anchors and grout all floor-mounted equipment.
F. Install all necessary wiring or interconnections as required.
G. Make all internal and external connections as indicated and as required by manufacturer's wiring diagrams.
H. Check all internal and external connections, especially current transformer secondary short-circuiting jumpers, and tighten as required.
I. Place arc flash label on equipment.

3.03 FIELD QUALITY CONTROL:

A. Field Testing:
   1. Perform tests described below and per SECTION 26 08 10.
   2. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
   3. Perform "start-up" tests as recommended by manufacturer and per NETA MTS (latest version).
   4. Prior to energization of circuitry, check all accessible connections to manufacturer's torque tightening specifications.
   5. Prior to energization, check for electrical continuity of circuits and for short-circuits.
   6. Prior to energization check with an insulation resistance tester: phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled. Record and submit field test data.
   7. Set all parameters associated with AHF for proper system performance. Settings shall be recorded and included with final documentation as specified.

B. Submit field testing and commissioning reports as specified in DIVISION 1.

3.04 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
   1. Touch Up:
      a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
      b. Field painting shall be performed based on the manufacturer's recommended procedures.
      c. Equipment manufacturer shall furnish Contractor with touch-up paint listed in spare parts paragraph above.

3.05 ADJUSTING AND CLEANING:

A. After field installation and final wiring terminations are completed the field connected power and control wiring and cables shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.
B. Prior to final acceptance the equipment interior and exterior shall be wiped clean and free from dust and debris.

3.06 TRAINING:

A. The equipment supplier shall provide a minimum of 4 hours of training at the customer's facility for operations, maintenance and service personnel.
   1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.
   2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, software mapping, programming, setup, configuration, control loop tuning, operational indicators, faults, diagnostic tools, troubleshooting, and preventive maintenance.
   3. Hands-on training shall be provided on equipment.
   4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.
B. The Owner at their option shall be allowed to video record all training sessions for future reference.

C. Contractor shall record the training sessions and provide a final edited version to the Owner on electronic video file format.

3.07 MAINTENANCE

A. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
B. Follow-up Infrared Scanning: Perform two follow-up infrared scans of equipment, one at four months and another at 11 months after Substantial Completion.
C. Instrument: Use infrared-scanning device designed to measure temperature or to detect significant deviations from normal values. Provide documentation of device calibration.
D. Report: Prepare certified report that identifies units checked and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

3.08 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 35 26

SECTION 26 36 00 - TRANSFER SWITCHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION includes transfer switches rated 600 V and less, including the following:
   1. Automatic transfer switches.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems.
B. SECTION 26 05 53 - Identification for Electrical Systems.
C. SECTION 26 05 73 - Electrical Studies.
D. SECTION 26 08 10 - Electrical Testing and Maintenance
E. SECTION 26 32 13 - Engine Generators.

1.04 REFERENCES:

A. Applicable Standards (latest edition):
   1. National Electrical Manufacturer's Association (NEMA):
      a. NEMA ICS 1 - Industrial Control and Systems General Requirements.
   2. National Fire Protection Association (NFPA):
      a. NFPA 70 - National Electrical Code.
      b. NFPA 101 - Life Safety Code.
      c. NFPA 110 - Standard for Emergency and Standby Power Systems.
   3. Underwriters' Laboratories (UL):
      a. UL 1008 - UL Standard for Safety Transfer Switch Equipment.

1.05 PERFORMANCE REQUIREMENTS:

A. Delegated Design: Design for seismic bracing and anchoring, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements, design criteria indicated, and related product information for equipment to be supplied.
B. Seismic Performance: Panelboards shall withstand the effects of earthquake motions. Refer to Structural design.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces or short circuit current specified and the unit will be fully operational after the seismic event."
C. Refer to Specification 26 00 00 for Project Site Conditions, and Electrical Material Service Requirements, Environmental Ratings & Hazardous Locations.

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Submittal is to include a copy of the governing Specification Section(s). Throughout each specification included, a check mark must be applied to each paragraph denoting the submittal contents agree with the specification language and requirements. If a specification paragraph cannot be fully met, then a sequential number must be clearly applied to the specification within the left-hand margin space. The submittal must include an itemized list containing each

sequential number used along with a complete description and reasoning of the discrepancy for engineer review. Submittals not containing the above will be cause for immediate rejection without further review.

C. Refer to Specification 26 05 73 – Electrical Studies. Short Circuit Study is to be approved prior to purchase orders for equipment being issued. Equipment where the specified short circuit current ratings are not sufficient shall be explicitly noted and recommendations shall be made to achieve selective coordination.

D. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

E. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Provide project-specific information indicating specific upstream-protective devices required to achieve indicated withstand current rating. Do not protect a transfer switch with a circuit breaker applied at its series rating.
2. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each transfer switch.
3. Controls wiring: Provide drawings showing locations of external controls and monitoring connections.

A. Qualification Data: For manufacturer and testing agency.

B. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. Include the following:

1. Requirements of Specification 01 78 00 – Closeout Submittals.
2. Features and operating sequences, both automatic and manual.
3. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable. Any programming of ATS shall be copied and given to owner as part of O&M submittal.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

B. Transfer switches shall be stored according to the manufacturer’s instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.

C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is

not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

D. Handle and prepare equipment for installation according to manufacturer's instructions.

1.08 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

B. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NEMA ICS 1.

F. Comply with NFPA 70.

G. Comply with NFPA 110.

H. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.09 PROJECT CONDITIONS:

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.10 COORDINATION:

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in DIVISION 03.

1.11 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.

B. Warranty shall include all parts, labor, and expenses to perform necessary work.

C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Contactor Transfer Switches:

a. Schneider Electric; ASCO Power Technologies. (300SE series)
b. Approved Equal

2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS:

A. Provide service entrance rated transfer switch meeting NEC requirements including service disconnecting breaker as shown on the drawings, and bonding requirements.
B. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30% of switch ampere rating, unless otherwise indicated.
C. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
   1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
D. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2% or better over an operating temperature range of minus 20 to plus 70ºC.
E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
F. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
   1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
   2. Switch Action: Double throw; mechanically held in both directions.
   3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts, with arc chutes.
H. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
I. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
J. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.
K. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
L. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in SECTION 26 05 53 - Identification for Electrical Systems.
   1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
   2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
   3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

N. Enclosures: General-purpose NEMA 250, Type 12, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.03 AUTOMATIC TRANSFER SWITCHES:

A. Comply with Level 2, type 10 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

G. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:

1. Fully automatic make-before-break operation.
2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
   a. Initiation occurs without active control of generator.
   b. Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5% maximum voltage difference.
4. Failure of power source serving load initiates automatic break-before-make transfer.

H. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70% or more of nominal voltage.

I. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.

J. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.

K. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source and generator: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100% of

nominal, and dropout voltage is adjustable from 75 to 98% of pickup value. Factory set for pickup at 90% and dropout at 85%.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100% of nominal. Factory set for pickup at 90%. Pickup frequency shall be adjustable from 90 to 100% of nominal. Factory set for pickup at 95%.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected, green for "normal", red for "emergency".
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
    a. Normal Power Supervision: White light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Yellow light with nameplate engraved "Emergency Source Available."
8. Push-to-Test Lights: All lights shall be push-to-test LED-type.
9. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-Vac.
10. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
11. Re-transfer to Utility Timer Override Pushbutton: Overrides load re-transfer to utility timer if utility is available.
12. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32Vdc minimum, to close (or open) to start engine, and to open (or close for engine shutdown).
13. Shutdown: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
14. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

2.04 SOURCE QUALITY CONTROL:

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Design each fastener and support to carry load indicated for the determined seismic loads.
B. Floor-Mounting Switch: Anchor to floor by bolting, per seismic design if necessary.
   1. Concrete Bases: 3.5 inches (100-mm) high, reinforced, with chamfered edges. Extend base 3 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to SECTION 26 05 29 - Hangers and Supports for Electrical Systems.
C. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.
D. Identify components according to SECTION 26 05 53 – Identification for Electrical Systems.
E. Set field-adjustable intervals and delays, relays, and engine exerciser clock.
F. ATS field representative to program the ATS exercising schedule to operate for 30 minutes every two weeks, or per Owner’s recommendations.

3.02 CONNECTIONS:

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
B. Ground equipment according to SECTION 26 05 26 - Grounding and Bonding for Electrical Systems.
C. Connect wiring according to SECTION 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

3.03 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform tests and inspections and prepare test reports.
B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
C. Perform tests and inspections and prepare test reports.
   1. Perform tests described below and per SECTION 26 08 10.
   2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
   3. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
   4. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   5. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages

and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
a. Check for electrical continuity of circuits and for short circuits.
b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

6. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
b. Simulate loss of phase-to-ground voltage for each phase of normal source.
c. Verify time-delay settings.
d. Verify pickup and dropout voltages by data readout or inspection of control settings.
e. If included, test bypass/isolation unit functional modes and related automatic transfer-switch operations.
f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50% from other poles.
g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

7. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
a. Verify grounding connections and locations and ratings of sensors.

D. Testing Agency's Tests and Inspections:
1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
a. Check for electrical continuity of circuits and for short circuits.
b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
b. Simulate loss of phase-to-ground voltage for each phase of normal source.
c. Verify time-delay settings.
d. Verify pickup and dropout voltages by data readout or inspection of control settings.
e. If included, test bypass/isolation unit functional modes and related automatic transfer-switch operations.
f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50% from other poles.

g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
   a. Verify grounding connections and locations and ratings of sensors.

E. Coordinate tests with tests of generator and run them concurrently. Generator supplier representative to be on site during testing of ats/generator combination.

F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

G. Remove and replace malfunctioning units and retest as specified above.

3.04 DEMONSTRATION:

A. In presence of the engineer or Owner, demonstrate functionality of the transfer switch by simulating a loss of utility power ensuring the generator starts according to the programmed settings, and the transfer switch engages power to the building loads. Perform demonstration in conjunction with the loaded tests indicated under Specification 26 32 13 – Engine Generator.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.

C. Coordinate this training with that for generator equipment.

3.05 MAINTENANCE

A. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

B. Follow-up Infrared Scanning: Perform two follow-up infrared scans of equipment, one at four months and another at 11 months after Substantial Completion.

C. Instrument: Use infrared-scanning device designed to measure temperature or to detect significant deviations from normal values. Provide documentation of device calibration.

D. Report: Prepare certified report that identifies units checked and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

3.06 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 36 00

SECTION 26 41 00 – LIGHTNING PROTECTION SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION includes the furnishing and installation of a complete lightning protection system, including below-grade ground grid systems.
   1. Air terminals.
   2. Roof conductors.
   3. Down conductors.
   4. All mounting accessories.

B. Furnish a Master Label Certificate issued by Underwriters' Laboratories, Inc. for each system and attach to the base of the appropriate structure.

C. Provide lightning protection for the following structures:
   1. Pump Station Building.

1.03 PERFORMANCE/DESIGN CRITERIA:

A. The lightning protection system design shall be completed by a qualified designer and installed by a Listed Lightning Protection Installer capable of providing an UL Master Label Inspection Certificate for each structure.

1.04 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 05 19 – Low Voltage Electrical Conductors and Cables.

B. SECTION 26 05 26 – Grounding and Bonding for Electrical Systems.

1.05 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. American National Standards Institute (ANSI).

C. Underwriters' Laboratories, Inc. (UL):
   1. 96 - Lightning Protection Components.
   2. 467 - Standard for Grounding and Bonding Equipment.

D. American Society for Testing and Materials (ASTM):
   1. B3 - Soft or Annealed Copper Wire.
   2. B8 - Concentric Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   3. B33 - Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.

E. National Fire Protection Association (NFPA):
   1. 70 - National Electrical Code.
   2. 780 - Installation of Lightning Protection System.

F. Lightning Protection Institute (LPI):
   1. 175 - Standard of Practice for the Design - Installation - Inspection of Lightning Protection Systems.

1.06 DEFINITIONS:

A. Definitions provided by NPFA 780:
   1. Class I Materials: Lightning conductors, air terminals, grounding electrodes, and associated fittings required for the protection of structures not exceeding 75 feet in height.
   2. Class II Materials: Lightning conductors, air terminals, grounding electrodes, and associated fittings required for the protection of structures exceeding 75 feet in height.

1.07 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Product Data: For each type of product indicated.
C. Shop Drawings: For air terminals and mounting accessories.
   1. Layout of the lightning protection system, along with details of the components to be used in the installation.
   2. Include indications for use of raceway, data on how any concealments requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.
   3. Mounting details for all components.
   4. Detailed layout drawings of lightning protection system, including air terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway and data on how concealment requirements will be met.
D. Qualification Data: For qualified Installer and manufacturer. Include data on UL listing.
E. Material Certificates:
   1. Certification, signed by Contractor, that roof adhesive is approved by manufacturer of roofing material.
F. Field quality-control reports.
   1. Comply with recommendations in NPFA 780, Annex D, “Inspection and Maintenance of Lightning Protection Systems,” for recommended inspection reports of the lightning protection system.
G. Plans showing dimensioned as-built locations of grounding features, including the following:
   1. Ground rods.
   2. Ground loop conductor.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

1.09 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. Installer Qualifications: Certified by UL as a Master Installer/Designer, trained and approved for installation of units required for this Project.
C. System Certificate:
   1. UL Master Label.
D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, “Definitions” Article.

1.10 PROJECT SITE CONDITIONS:

1. Refer to Section 26 00 00 for Project Site Conditions

1.11 COORDINATION:

A. Coordinate installation of lightning protection system with the installation of other building systems and components including electrical wiring, supporting structures, building materials, roof, and metal components requiring interface with lightning protection systems.
B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.
C. Flashings of through-roof assemblies shall comply with roofing manufacturers' specifications.

1.12 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Lightning Protection System Components:
    1. Preferred Lightning Protection.
    2. Robbins Lightning Protection.
    3. Thompson Lightning Protection, Inc.
    4. Erico International Corporation.
B. Grounding Components:
    1. Burndy LLC.
    2. Erico International Corporation.
    3. Thomas & Betts.
C. Bare Ground Cable:
    1. Refer to SECTIONS 26 05 19 and 26 05 26.
D. Connection Materials:
    1. Exothermic Type Welding Process:
        a. Erico Products (CADWELD).
    2. Compression Type Connectors:
        a. Amp.
        b. Burndy.
        c. Thomas and Betts.
E. Ground Test Wells:
    1. Advanced Lightning Technology.
    2. Erico International Corporation.
    3. Synertech.
F. Mastic:
    1. Sonneborn-Sonoshield Mastics.
    2. W.R. Meadows-Sealmastic.

2.02 PERFORMANCE/DESIGN CRITERIA:

A. Materials shall be in compliance with the following standards:
    1. UL96.
    2. NFPA 780.
    3. All materials used for the system installation shall comply in size, composition, and weight to all requirements of NFPA and UL for the class of system in which they are

installed. All materials shall be labeled or listed by UL for use in Master Labeled Systems.

4. Roof and down conductors shall be in compliance with ASTM B8.

2.03 LIGHTNING PROTECTION SYSTEM:

A. General Requirements:
   1. Material: All materials shall be aluminum, copper, or bronze.
   2. Compatibility: All portions of the system shall be galvanically compatible to the building material to which they are to be attached. Connections between copper and aluminum portions of the system shall be made with appropriate bimetallic coupling devices. In all areas, the conductor shall be supported to maintain clearance from all galvanically incompatible materials or shall be of the same material.
   3. All system components shall be, to the maximum extent possible, the product of a single manufacturer. All components shall be type Class I as required by NFPA 780.

B. Air Terminals:
   1. Solid Air Terminal Rods:
      a. Diameter: 1/2-inch diameter.
      b. Length: 18 inches.
      c. Material: Copper or Aluminum. Ensure compatibility with base and roofing materials.
   2. Mounting hardware:
      a. Mounting Base Material: Copper or Aluminum. Ensure compatibility with base and roofing materials.
      b. Mounting Type: Roof, Side, Universal, as required.
      c. Anchor: Provide adhesive or metallic anchor compatible with building materials. Adhesives to be compatible with roofing membranes, where present.
   3. Air terminals and interconnecting cable shall be provided for all roof-mounted equipment subject to a direct strike as required by NFPA 780.
   4. All air terminal bases shall be securely mounted to the building structure by bases secured as specified.

C. Roof and Down Conductors:
   1. Material: Aluminum or copper. Ensure compatibility with roofing materials.

D. Down Conductor Guards: Guards shall be of self-extinguishing, high-impact polyvinyl chloride or polyethylene.

E. Grounding Grid System: Refer to SECTION 26 05 26 and to Electrical Drawings.

F. Ground Test Wells:
   1. Concrete or high-density polymer concrete box or ring with bolted cover.
   2. Cover shall be permanently marked as “Electrical” or “Ground Test Well.”
   3. Refer to SECTION 26 05 26.

G. Bonding Plates, Connectors, Terminals, and Clamps: Provide electrical bonding plates, connectors, terminals, lugs, and clamps as recommended by bonding plate, connector, terminal, and clamp manufacturers for indicated applications.
   1. Bolted Connectors for Pipes: Copper or copper-alloy, pressure type with at least two silicon bronze or stainless-steel bolts and lock washers.
   2. Irreversible Compression Fittings: Pure wrought copper extrusion clamps and connectors, made to be held in the dies of an installation tool. Connectors must be factory filled with an oxide inhibitor.
   3. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Lightning Protection System:
   1. Install lightning protection systems as indicated, in accordance with equipment manufacturer's written instructions, and in compliance with UL 96A.
   2. Suitably protects cable and air terminals from damage during construction.
   3. Air Terminals:
      a. The structural steel framework of building may be used as the main conductor of a lightning protection system.
      b. Air terminals shall be installed within 2 feet of all ends, edges, and corners of the building.
      c. Place air terminals so that roof hatches fall within the zone of protection. Bond roof hatches to the lightning protection system with braided bonding jumpers.
   4. Conductors:
      a. Protect down conductors from physical damage and displacement by installing guards.
      b. Install conductor with direct paths from air terminals to ground connections avoiding sharp bends (minimum radius - 8 inches and no bends shall be less than 90 degrees) and narrow loops. Where indicated, run conductors in nonmetallic PVC raceway Schedule 80 with a minimum elbow radius of 8 inches.
      c. Conceal the following conductors:
         (1) Down conductors.
      d. Do not install copper lightning protection materials on aluminum roofing, siding material, or other aluminum surfaces. On aluminum surfaces, use aluminum lightning protection materials.
   5. Bonding: Install in accordance with UL 96A, NFPA 780, and the NEC.

B. Connection Materials:
   1. Cable-to-cable, cable-to-rod connection shall be exothermic-type welding process or irreversible compression type connectors. All compression-type connections shall be inspected for proper die index number.
   2. Provide bimetallic or tin-plated copper connectors when joining copper to aluminum conductors.
   3. Cable to structural steel:
      a. Use exothermic weld where possible.
      b. Where exothermic weld will damage structural steel, use bolted fittings if it can be field drilled.
      c. Use irreversible compression ground clamp with breakaway bolt head to building steel that cannot be altered.
      d. When structural steel is used as part of the lightning protection system, the structural steel shall be electrically continuous and shall be bonded to the lightning protection conductors at both the top and the bottom of the structural columns.
   4. Cable to Equipment Ground Lugs:
      a. Copper alloy terminal with twin clamping element.
      b. Bolt to equipment housing with silicon bronze or stainless-steel bolts and lock washers.

C. Ground Grid System:
   1. Wire and Cable:
      a. General:

(1) Install using as few joints as possible.
(2) Protect against unraveling, caging, and abrasion by wrapping plastic tape on all ends.
(3) Install so as not to be entirely encircled or closely encircled by magnetic material.
(4) Suitably protect against damage during construction. Replace or repair cable at Owner's discretion if cable is damaged by anyone before final acceptance.
(5) Protect cable at all points where cable leaves concrete by wrapping rubber tape on 2 inches either side of the plane formed by the finished concrete surface.

b. Buried Installations:
(1) Install at locations and depths as specified or indicated. Otherwise install at least 18 inches below finished grade or deeper, if necessary, in order to be in contact with earth. Install outside of foundation or wall at not less than 2 feet.
(2) Maintain clearance of at least three feet from all underground metal piping or structures where possible, otherwise tape all ground conductors within this clearance.
(3) Backfill with excavated earth free from rocks or stones. Thoroughly compact backfill.

2. Ground Rods:
a. Install rods where indicated by driving and not by drilling or jetting.
b. Drive rods into unexcavated portion of the earth where possible.
c. Where rods must be installed in excavation areas, drive rods into earth after compaction of backfill is completed.
d. Drive to a depth such that the top of rods will be approximately 18 inches below final grade, or subgrade, and connect to the buried grid ground conductors.

3. Connections:
a. Conform to manufacturer's instructions.
b. Chemically degrease and dry completely before welding or applying compression type connectors.
c. Apply coating to all exothermic-welded connections to be buried, at 15-mils dry film thickness, after checking of connections by Owner’s Engineer.
d. Make up bolted connections clean and tight.
e. Low-resistance connections with resistance drop not exceeding 1 ohm.
f. Do not cover up connections before they are checked by Engineer.

4. Ground Test Wells:
a. Install at locations indicated on Drawings.
b. Use bolted connections at test wells.

5. The lightning protection system shall be permanently bonded to the grounding electrode system per NPFA 780.

D. Corrosion Protection:
1. Use no combination of materials that may form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture, unless moisture is permanently excluded from the junction of such metals.
2. Where unusual conditions exist that would cause deterioration or corrosion of conductors, use conductors with suitable protective coatings.
3. Aluminum down conductors shall not be used where contact with the earth is possible.

E. Sleeve and Sleeve Seal Installation for Electrical Penetrations:
1. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.02 FIELD QUALITY CONTROL:

A. Notify Engineer at least 48 hours in advance of inspection before concealing lightning protection components.

B. Provide inspection according to UL 96A and delivery of UL Master Label Certificate to Owner.

3.03 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 41 00

SECTION 26 43 13 – SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION includes parallel and series-wired, surge protective devices (SPDs) for service entrance and AC distribution equipment not exceeding 1000V, including disconnects, switchboards, motor control centers, panelboards, as well as point-of-service equipment, power for control panels.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 08 10 - Electrical Testing and Maintenance
B. SECTION 26 24 13 - Switchboards
C. SECTION 26 24 16 - Panelboards

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. National Fire Protection Association (NFPA):
    1. NFPA 70 – National Electrical Code (NEC)
        a. Article 285 – Surge-Protective Devices (SPDs) 1 kV or Less.
    2. NFPA 780 – Standards for the Installation of Lightning Protection Systems.
C. National Electrical Manufacturers Association (NEMA). Comply with applicable requirements of the following standards:
    1. NEMA 250 – Enclosures for Electrical Equipment (1,000V maximum).
D. Underwriters Laboratories (UL). Comply with applicable requirements of the following standards:
    1. UL 1283 – Electromagnetic Interference Filters.
    2. UL 1449 4th Edition, or newer – Surge Protective Devices.
E. Institute of Electrical and Electronic Engineers (IEEE) comply with applicable requirements of the following standard.
    1. IEEE C62.33 – Test Specifications for Varistor Surge-Protective Devices.
    2. IEEE C62.41.1 – Surge Environment in Low-Voltage (1000V and less) AC Power Circuits.
    3. IEEE C62.41.2 – Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits.
    4. IEEE C62.45 – Surge Testing for Equipment Connected to Low Voltage (1000V and less) AC Power Circuits.
    5. IEEE C62.62 – Test Specification for Surge Protective Devices for Low Voltage AC Power Circuitry.
    6. IEEE Std 1100 (Emerald Book) – Recommended Practice for Powering and Grounding Electronic Equipment.

1.05 DEFINITIONS AND ABBREVIATIONS:

A. I-n: I-nominal rating.
B. MCOV: Maximum Continuous Operating Voltage rating.
C. MOV: Metal Oxide Varistors.
D. SAD: Silicon Avalanche Diodes.
E. SCCR: Short Circuit Current Rating.
F. SPD: Surge Protection Device.
G. VPR: Voltage Protection Rating.

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Product Data:
    1. Data sheets:
        a. Physical details and dimensions.
        b. Power input voltage and frequency.
        c. Type category.
        d. UL 1449 Listing documentation verifying the following:
            (1) Short Circuit Current Rating (SCCR).
            (2) Voltage Protection Ratings (VPRs) for all modes.
            (3) Maximum Continuous Operating Voltage rate (MCOV) for Type 2 SPDs.
            (4) I-nominal rating (I-n) for Type 2 SPDs.
            (5) Device type designation.
        e. Peak surge current rating per phase.
    2. Tests, inspections: At the shop, factory, plant, or place of manufacture.
    3. Verification of performance: Compliance with specified criteria.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C700-7.13.
B. Integral SPDs shall be delivered, pre-installed, and stored according to the requirements of the distribution equipment or control panel in which they are installed.

1.08 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

1.09 SITE CONDITIONS:

A. All Equipment provided as part of this system shall be rated for the temperature, seismic and elevations as specified in the Site Conditions in SECTION 26 00 00.

1.10 SPARE PARTS

A. For pluggable spds (control panels, etc.) provide a spare pluggable cartridge for each pole.

1.11 WARRANTY

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. A manufacturer's presence on this list does not guarantee that all of its models are acceptable. The Contractor shall verify each SPD model meets all requirements of this specification.

B. AC Power Distribution Units:
   1. Advanced Protection Technologies, Inc.
   2. Eaton.
   3. Erico International Corporation.
   4. General Electric.
   5. Mersen.
   6. Schneider Electric.
   7. Siemens.

2.02 GENERAL REQUIREMENTS FOR SURGE PROTECTIVE DEVICES:

A. UL 1449 listed and labeled.

B. Shall be UL labeled as a Type 2 device, shall be intended to be installed on the load side of the service entrance equipment and shall not require external or supplemental overcurrent safety controls to meet UL 1449.

C. The surge protective device (SPD) shall be of a non-modular design using fast-acting transient energy protection that will divert and dissipate the surge energy.

D. Shall provide independent, directly-connected suppression components on each mode in the electrical distribution system, at least seven modes in Wye systems (L-N, L-G, N-G) and six modes (L-L, L-G) in Delta and impedance grounded Wye systems.

E. Shall be an integral or internally-mounted device as specified or indicated.

F. Shall use metal oxide varistor or MOV-hybrid technology as necessary. (Spark gaps, selenium cells and SCRs shall not be acceptable.)

G. Shall include internal fuses and thermally protection over every suppression component of every mode, including N-G unless protecting the service entrance.

H. Shall have integral, panel front status monitors or remote status panel ability as a minimum to indicate a continuous positive status of all protected modes, including N-G mode where applicable. Diagnostics shall be electrically isolated to prevent damage by surges.

I. Shall be UL labeled with a short circuit current rating of 200kA.

J. The maximum continuous operating voltage at 60 Hz shall be capable of sustaining at least 115% of the peak voltages continuously without degrading.

K. The maximum UL 1449 Voltage Protection Ratings (VPR) for the device must not exceed the following:

Service	L-N	L-G	N-G	L-L	MCOV
120V 2-wire + Gnd	600V	1000V	600V	NA	150
120/240Vac	700V	700V	700V	1200V	150

3-Wire + Gnd					
208/120Vac 3-phase, 3 or 4-wire	700V	700V	700V	1200V	150/276
480 Vac 3-phase, 3 Wire Delta	NA	1800V	NA	1800V	550
480/277 Vac 3-phase, 3-wire or 4-wire	1200V	1200V	1200V	2000V	550/320

L. Type 2 SPDs shall be UL labeled with 20kA I-n for compliance to UL 96A Lightning Protection Master Label and NFPA 780 with the following minimum protection characteristics:
   1. UL 1283 Listed. (Latest Edition)
   2. I_n: 20kA (per mode)
   3. SCCR: 100kAIC (minimum)
   4. MCOV: 550V
   5. UL Voltage Protection Rating:
      a. L-L: 1800V
      b. L-N, L-G, N-G: 900V
   6. Response time of less than 25 nanoseconds.

M. Provide SPDT contacts for remote indication. Contacts rated 5A at 120Vac minimum.

N. Equipped with an LED status indicator for verification that unit is functioning.

O. Minimum five year warranty.

2.03 SERVICE ENTRANCE SURGE PROTECTIVE DEVICE:

A. The SPD shall be suitable for 480/277V, 3-phase, 4-wire 60 Hz, service-entrance equipment.

B. Service entrance units shall be tested and demonstrated suitable for application within ANSI/IEEE C62.41 Category C environments.

C. Shall have a peak surge current of 240 kA per phase.

D. Shall include EMI/RFI filtering for ring wave suppression.

E. Shall have a minimum EMI/RFI filtering of -30dB at 100 kHz.

F. Filters in the N-G mode shall not be allowed.

2.04 SURGE PROTECTIVE DEVICE FOR DOWNSTREAM MOTOR CONTROL CENTERS, AND DISTRIBUTION PANELBOARDS:

A. The SPD shall be suitable for 480/277V, 3-phase, 4-wire 60Hz.

B. Downstream SPD units shall be tested and demonstrated suitable for application with ANSI/IEEE C62.41 Category B environments.

C. Shall have a peak surge current of 120kA per phase.

D. Minimum surge current capacity (I_{max}) of 40 kA per mode (8/20µs).

E. Internally-mounted units shall have a NEMA 1 enclosure designed for back panel or DIN rail mounting within a control panel or motor control center.

F. Shall include EMI/RFI filtering for ring wave suppression.

G. Shall have a minimum EMI/RFI filtering of -30dB at 100 kHz.

H. Minimum five year warranty.

2.05 SURGE PROTECTIVE DEVICE FOR LIGHTING AND RECEPTACLE PANELBOARDS

A. Surge suppressors shall be installed to protect at 120/208V 3-phase and 120/240V, 1-phase, 3-wire 60Hz distribution.
   1. Shall meet Type 2 SPD criteria with the following minimum protection characteristics:
      a. Shall have a peak surge current of 50kA per phase.
      b. I_n: 25kA (per mode)
      c. SCCR: 100kAIC (minimum)
      d. MCOV: 150V (L-G), 270 (L-L).
      e. UL Voltage Protection Rating:
         (1) L-L: 1000V
         (2) L-N, L-G, N-G: 600V
   2. Designed for 120/208V 3-phase or 120/240Vac, single-phase operation as required.
   3. EMI/RFI filtering.
   4. Peak clamping voltage of 320 volts line to neutral and 350 volts line to ground with Category B waveform.
   5. Response time of less than 25 nanoseconds.
   6. Equipped with an LED status indicator for verification that unit is functioning.

B. Shall be designed to pass the appropriate IEEE testing standards included below:
   1. IEEE C62.11.
   2. IEEE C62.33.
   3. IEEE C62.36.
   4. IEEE C62.45.
   5. IEEE C62.62.

2.06 SURGE PROTECTIVE DEVICE FOR CONTROL PANELS

A. Surge suppressors shall be installed to protect at 120/240V, 1-phase, 3-wire 60Hz distribution.
   1. Shall meet Type 2 SPD criteria with the following minimum protection characteristics:
      a. Nominal Discharge Current I_n: 20kA
      b. Max Discharge Current I_{max}: 40kA
      c. SCCR: 25kAIC (minimum)
      d. MCOV: 320V (L-G), 277V (N-G)
      e. Voltage Protection Rating:
         (1) L-N: 1200V
         (2) L-G, N-G: 700V
   2. Designed for 120Vac, single-phase operation.
   3. DIN Rail mounted.
   4. Minimum surge current capacity of 10 kA per mode (8/20µs).
   5. Equipped with an LED status indicator for verification that unit is functioning.

B. Shall be designed to meet:
   1. IEC 61643-11
   2. EN-61643-11
   3. UL 1449

C. Acceptable Manufacturers:
   1. Mersen, Model #: STPT2-40K150V-2PM
   2. Approved equal

2.07 ADDITIONAL REQUIREMENTS FOR PLUG-ON SPDS:

A. Shall be directly connected to the equipment bus bar through an integral circuit breaker sized as recommended by the manufacturer.

B. Shall include a display with a resettable counter for the combined total number of transient voltage surges detected since the counter was reset.

2.08 ADDITIONAL REQUIREMENTS FOR SPDS INTEGRAL TO THE POWER DISTRIBUTION EQUIPMENT:

A. The SPD shall be mounted to the equipment by a direct bus bar connection.

B. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, or sub-feed breaker options.

C. The power distribution equipment shall be capable of re-energizing upon removal of the SPD.

2.09 ACCESSORIES:

A. Monitoring Diagnostics/Accessories:

1. Protection Status Indicators - Each unit shall have a green/red solid-state indicator light that reports the status of the protection element on each phase.
    a. Wye configured units, shall have indication in the L-N and L-G and N-G modes.
    b. Delta configured units, shall have status indication in the L-G and L-L modes.
    c. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
2. Surge Event Counter: The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location.
    a. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
    b. The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

2.10 FINISHES:

A. Manufacturer shall prepare surfaces, prime, and finish paint all surfaces with manufacturer's standard coating system. Coating system and color shall be suitable for intended services.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine area and location of equipment to receive SPDs for compliance with manufacturer's environmental conditions and other conditions affecting performance of the Work.
B. Examine field installed SPDs before installation. Reject SPDs that have been wet, moisture damaged, or physically damaged.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 GENERAL INSTALLATION REQUIREMENTS:

A. The installation of the surge suppression system shall be installed in strict accordance with the manufacturer's recommended practices and in compliance with the NEC.
B. The Contractor shall verify the proper application of the SPD (i.e. voltage, phases, etc.)
C. The Contractor shall verify that all neutral conductors are bonded to the system ground at the service entrance or at the serving transformer prior to installation of the SPD.
D. The phase, neutral and grounding conductors serving the SPD shall be gently twisted to reduce the SPD system inductance and shall be kept at the minimum length. Avoid any sharp bends and coils in the conductors.
E. Do not perform insulation resistance tests on a piece of electrical equipment with an SPD installed. SPDs are not designed to withstand the relatively high voltages applied for the duration of a megger test measured in seconds. Disconnect the SPD during insulation testing and reconnect immediately after testing is over.

3.03 INSTALLATION OF EXTERNALLY-MOUNTED SPDS:

A. Externally mounted SPDs are only permitted with Approval from the Owner.
B. The SPD shall be located immediately adjacent or nippled to the equipment being protected to meet the manufacturer recommended installation.
C. Provide a disconnecting means or overcurrent protection and wiring as recommended by the manufacturer. When no recommendation is provided install the SPD through a 30-Amp circuit breaker using 10-gauge wire.
D. When installed at a service entrance, the SPD shall be installed on the load side of the main service disconnect overcurrent device.
E. When installed at a separately-derived system, the SPD shall be connected on the load side of the first overcurrent device.
F. When protecting a panelboard, switchboard or motor control center, install the SPD through a breaker as a disconnecting source per the manufacturer's installation instructions. Installer may reasonably rearrange breaker locations to ensure short and straightest possible leads to SPD.
G. If the lead length exceeds 18-inches, the Contractor shall notify the Owner and contact the surge suppression manufacturer for installation assistance.
H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 468A and the National Electrical Code.
I. The SPD installation shall be certified by a licensed electrician that the installation is in accordance with the manufacturer's recommendations, applicable electrical code requirements, and the requirements of this specification. Any deficiencies noted shall be corrected by the Contractor. Provide written documentation of this inspection as part of the closeout documentation.

3.04 INSTALLATION OF INTERNALLY-MOUNTED SPDS:

A. When installed within a switchboard, motor control center, or panelboard, the SPD shall be installed in a dedicated bucket or space.

B. Provide a disconnecting means or overcurrent protection and wiring as recommended by the manufacturer. When no recommendation is provided install the SPD through a 30-Amp circuit breaker using 10-gauge wire.

3.05 FIELD QUALITY CONTROL:

A. Perform tests and inspections: Inspect SPDs, modules, connections, and installation. Test and Inspect SPDs for proper function per manufacturers recommendations.

3.06 FINISHES:

A. Externally Mounted SPDs are permitted with approval of the Owner: SPD enclosure coatings shall be free from scratches, rust, or other defects.

B. All damaged or defective coatings shall be repaired prior to final acceptance.

C. Field Painting:

1. Touch Up:
    a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
    b. Field painting shall be performed based on manufacturer's recommended procedures.
    c. Contractor shall provide the necessary quantity of Manufacturer's touch-up paint to match the factory applied finish.

3.07 ADJUSTING AND CLEANING:

A. For externally mounted SPDs: After field installation and final wiring terminations are completed the SPD wiring and cables shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.

B. Prior to final acceptance enclosure interior and exterior shall be wiped clean and free from dust and debris.

3.08 DEMONSTRATION:

A. Upon completion of installation of SPDs and associated electrical circuitry, energize circuitry and demonstrate functioning of equipment in accordance with manufacturer's requirements. Where possible, correct any malfunctioning units at the project site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

3.09 TRAINING:

A. Provide a minimum of 1 hours of training for each type of SPD provided at the customer's facility for operations, maintenance, and service personnel.

1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.
2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, faults, diagnostic tools, troubleshooting, and preventive maintenance.
3. Hands-on training shall be provided on equipment. Specific training shall demonstrate the replacement procedures for SPD modules.

4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.

B. Contractor shall record the training sessions and provide a final edited version to the Owner on a video DVD-ROM and electronic video file format.

3.10 BASIS OF PAYMENT

A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 43 13

SECTION 26 50 00 – LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION includes the following:
   1. Interior Luminaires:
      a. Light-emitting Diode (LED).
   2. Exterior luminaires.
      a. Light-emitting diode (LED).
   3. Emergency lighting.
   4. Exit signs.
   5. Drivers.
   6. Emergency drivers
   7. Luminaire accessories.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 00 00 – General Electrical Requirements.
B. SECTION 26 05 26 – Grounding and Bonding for Electrical Systems.
C. SECTION 26 05 33 – Raceways, Boxes, Seals, and Fittings for Electrical Systems.
D. SECTION 26 05 53 – Identification for Electrical Systems.
E. SECTION 26 27 26 – Wiring Devices.

1.04 REFERENCE STANDARDS:

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO LTS – Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals; American Association of State Highway and Transportation Officials; 5th Edition, with 2011 Interim Revisions.
B. American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE):
   1. ANSI/IEEE C62.41.2 – Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits; 2002 (Cor 1, 2012).
   2. ANSI/IEEE C136.10 – American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.
C. Illuminating Engineering Society of North America (IESNA):
   1. IESNA LM-63 – ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
   2. IESNA LM-64 – Photometric Measurements of Parking Areas; 2001 (Reaffirmed 2007).
   3. IESNA LM-79 – Electrical and Photometric Measurements of Solid-State Lighting; Latest Edition.
D. National Electrical Contractors Association (NECA):
   1. NECA 1 – Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
   2. NECA/IESNA 500 –Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.

3. NECA/IESNA 501 – Recommended Practice for Installing Exterior Lighting Systems; 2006.
4. NECA/IESNA 502 – Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.

E. National Fire Protection Associations (NFPA):
1. NFPA 70 – National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
2. NFPA 101 – Life Safety Code; National Fire Protection Association; 2012.

F. Underwriters Laboratories (UL):
1. UL 844 –Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
2. UL 924 – Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
3. UL 1598 – Luminaires; Current Edition, Including All Revisions.
4. UL 8750 – Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS:

A. Coordination:
1. Coordinate the installation of luminaires with mounting surfaces installed under other Sections or by others. Coordinate the Work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other Sections or by others.
3. Coordinate the placement of exit signs with equipment, signage or other potential obstructions to visibility installed under other Sections or by others.
4. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.06 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.

B. Shop Drawings:
1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features. Arrange in order of luminaire designation.
1. LED control gear, controllers, arrays, modules, and packages
2. Include rated life, color temperature, color rendering index (CRI), initial and mean lumen output, and energy efficiency data.
3. Emergency Lighting Units: Battery and charger data.
4. Exit Signs: Battery and charger data.

5. Provide means of attaching luminaires to supports, and indication that attachment is suitable for components involved.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of Project.
1. See DIVISION 1 for additional Equipment and Materials provisions.
2. Extra Lenses and Louvers: 2% of total quantity installed for each type, but not less than one of each type.
3. Extra Globes and Guards: 2% of total quantity installed for each type, but not less than one of each type.
4. Extra Fuses: 5% of total quantity installed for each type, but not less than two of each type.
5. Extra LED drivers: 2% of total quantity installed for each type, but not less than one of each type.

G. Project Record Documents: Record actual connections and locations of luminaires, any associated pull or junction boxes, and any remote components.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C700-7.13.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

B. Conform to requirements of NFPA 70.

C. Maintain at the Project Site a copy of each referenced document that prescribes execution requirements.

D. Provide luminaires from a single manufacturer for each luminaire type.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this SECTION with a minimum of three years documented experience.

F. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.09 FIELD CONDITIONS:

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of after completion of startup as defined below.

B. Warranty shall include all parts, labor, and expenses to perform necessary work.

C. Interior Lighting:
1. LED luminaires shall have a minimum 5-year manufacturer warranty.
2. Provide five-year pro-rata warranty for batteries for emergency lighting units.
3. Provide ten-year pro-rata warranty for batteries for self-powered exit signs.

4. Provide a three-year full warranty for emergency drivers.

D. Exterior Lighting:
   1. Provide five-year manufacturer warranty for all exterior luminaires.
   2. Provide five-year manufacturer warranty for metal corrosion.
   3. Provide five-year manufacturer warranty for color retention.

E. Repair or replace all luminaires that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

F. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Luminaires:
   1. Acuity Brands, Inc.
      a. Holophane.
      b. Lithonia.
      c. Mark Architectural Lighting.
      d. Peerless.
   2. Benjamin Division; Thomas Industries Inc.
   3. Cooper Lighting, a division of Eaton.
   4. CPM Lighting, Inc. (Columbia-Prescolite-Moldcast).
   5. Day-Bright Lighting, Division of Emerson Electric Co.
   6. Hubbell Lighting, Inc.
   7. KIM Lighting, Inc.
   8. Lutron Electronics Company, Inc.
   9. HE Williams.
   10. Philips Lighting.

B. Emergency Lighting Units and Exit Signs:
   1. Acuity Brands, Inc.
   2. Cooper Lighting, a division of Eaton.
   3. Hubbell Lighting, Inc.
   4. HE Williams.
   5. Philips Lighting.

C. Drivers:
   1. General Electric Company/GE Lighting.
   2. Iota Engineering.
   3. Lutron Electronics Company, Inc.
   4. Osram Sylvania.
   5. Philips Lighting Electronics/Advance.
   6. Manufacturer Limitations: Where possible, for each type of luminaire provide Drivers produced by a single manufacturer.

D. Emergency Drivers:
   1. Iota Engineering, LLC.
   2. Lithonia Lighting.
   3. Philips Emergency Lighting/Bodine.
   4. Manufacturer Limitations: Where possible, for each type of luminaire provide emergency drivers produced by a single manufacturer.

E. Light Sensitive Control Devices:

1. Cooper - Crouse-Hinds, a division of Eaton.
2. Intermatic, Inc.
3. Fisher-Pierce, Sunrise Technologies of the Electro Switch Corporation.

F. Motion Sensing Devices.
1. RAB.

2.02 LUMINAIRE TYPES:

A. Furnish products as indicated in the luminaire schedule included on the Contract Drawings.

2.03 LUMINAIRES:

A. Provide products that comply with requirements of NFPA 70.
B. Provide products that are listed and labeled as complying with UL 8750, where applicable.
C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
D. Provide products complying with Federal Energy Management Program (FEMP) requirements.
E. Provide products labeled as vibration and shock resistant and shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
F. Provide exterior lighting products complying with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
G. Unless otherwise indicated, provide complete luminaires including LED control gear, controllers, arrays, modules, and packages, reflectors, lenses, housings and other components required to position, energize and protect the light source and distribute the light.
H. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc., as necessary for a complete operating system.
I. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
J. Interior Luminaire Materials:
1. Metal Parts:
a. Free of burrs and sharp corners and edges.
b. Sheet metal components shall be steel unless otherwise indicated.
c. Form and support to prevent warping and sagging.
2. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit components without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during repairs and when secured in operating position.
3. Diffusers and Globes:
a. Acrylic Diffusers: 100% virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
b. Glass: Annealed crystal glass unless otherwise indicated.
c. Lens Thickness: At least 0.125-inch (3.175 mm) minimum unless otherwise indicated.
4. Housings:
a. Extruded-aluminum housing and heat sink.
b. Painted finish after fabrication, finish as indicated in luminaire schedule.
5. Conduit: Minimum 3/4 inch (21 mm) in diameter, type as specified.
6. Comply with Comply with UL 8750 and CSA C22.2 No. 250.13. Include recommended LED control gear, controllers, arrays, modules, and packages. Labels shall be located

where they will be readily visible to service personnel, but not seen from normal viewing with unit properly enclosed.

7. Metal Finishes:
   a. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples, and if they can be assembled or installed to minimize contrast.

K. Exterior Luminaire Materials:
1. Metal Parts: Free of burrs and sharp corners and edges.
2. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
3. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
4. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit repairs without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect driver when door opens.
5. Exposed Hardware Material: Stainless steel.
6. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
7. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
8. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
   a. White Surfaces: 85%.
   b. Specular Surfaces: 83%.
   c. Diffusing Specular Surfaces: 75%.
9. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
10. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
11. Factory-Applied Labels: Comply with Comply with UL 8750 and CSA C22.2 No. 250.13. Include recommended LED control gear, controllers, arrays, modules, and packages. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles with unit properly enclosed.

L. LED Luminaires:
1. General:
   a. LED Luminaire Components: UL 8750 recognized or listed as applicable. Tested according to LM-79.
   b. Luminaires shall be binned with a minimum of a three-step MacAdam Ellipse to ensure color consistency among luminaires.
2. LED Luminaires with Integral LEDs:
   a. Correlated Color Temperature (CCT):
      (1) 4,000K unless otherwise indicated.
   b. Color Rendering Index (CRI): Not less than 80.
   c. Average Rated Life: Not less than 50,000 hours for an operating cycle of three hours per start.

d. Luminaires shall be dimmable from 100% to 5% of maximum light output where indicated.
e. LED Assembly shall be mounted to die cast aluminum housing for thermal management.
f. LED drivers shall have a power factor greater than 0.90 lagging and less than 20 percent total harmonic current distortion (THD).
g. Operating temperature of LED assembly and fixture shall be rated for -30 to +40°C ambient.
h. Fixture shall be UL listed for operation in damp locations when indicated.

M. Luminaires Mounted in Continuous Rows:
1. Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.04 EXIT SIGNS:

A. Description: Exit signs and similar signs for special purpose applications such as area of refuge/rescue assistance.
B. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes and listed and labeled as complying with UL 924.
1. Number of Faces: Single or double as indicated or as required for the installed location.
2. Directional Arrows: As indicated or as required for the installed location.
C. Self-Powered Exit Signs:
1. Operation: Upon interruption of normal power source or brownout condition exceeding 20% voltage drop from nominal, solid-state control automatically switches connected light sources to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
4. Provide low voltage disconnect to prevent battery damage from deep discharge.
5. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
D. Accessories:
1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
2. Provide compatible accessory wire guards where indicated.

2.05 DRIVERS:

A. LED Drivers:
1. Provide LED drivers that are UL recognized complying with UL 8750.
2. Inrush Current: Not exceeding peak currents specified in NEMA 410.
3. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of ±10%.
4. Total Harmonic Distortion: Not greater than 20%.
5. Power Factor: Not less than 0.95.
6. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
7. Compatibility: Specifically designed for use with the specified LEDs, with no visible flicker and for full light output unless dimmer or bi-level switching control is indicated.

8. Driver Operating Frequency: Greater than 40 kHz.
9. Current Crest Factor: Not greater than 1.5.
10. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
11. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer applications.
12. Driver Marking: Include wiring diagrams with light source (LED) connections.

2.06 EMERGENCY DRIVERS:

A. LED Emergency Drivers:
1. Description: Self-contained, battery powered, LED emergency driver units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
2. Compatibility:
   a. Drivers: Compatible with AC drivers and LED loads rated for Class 2 output.
3. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the emergency driver for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
4. Emergency drivers shall include sufficient time delays to prevent overcurrent of the LED's in the event both emergency and standard drivers supply load simultaneously.
5. Battery:
   a. Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated. Minimum 7-year life expectancy.
   b. Recharge time shall be 24 hours or less.
6. Emergency Illumination Output:
   (1) Operate at lumen output necessary to achieve required illumination.
7. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.
8. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status and field selectable audible alert.
9. Operating Temperature: From 32ºF (0ºC) to 122ºF (50ºC) unless otherwise indicated or required for the installed location.
10. Accessories:
    a. Provide compatible accessory remote combination test switch/indicator light where indicated.

2.07 LIGHT SOURCES:

A. LED Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
1. Correlated Color Temperature (CCT):
   (1) Indoor: 4,000K unless otherwise indicated.
   (2) Outdoor: 4,000K unless otherwise indicated.
2. Color Rendering Index (CRI): Not less than 80.
3. Average Rated Life: Not less than 50,000 hours for an operating cycle of three hours per start.

4. Luminaires shall be dimmable from 100% to 0% of maximum light output where indicated.

2.08 ACCESSORIES:

A. Interior Lighting:
   1. Stems for Suspended Luminaires: Steel tubing, minimum 1/2-inch size, factory finished to match luminaire or field-painted as directed.
   2. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4-inch size, field-painted as directed.
   3. Wires for Suspended Luminaires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gauge (2.68 mm).
   4. Wires for Suspended Luminaires in Humid Spaces: ASTM A580/A580M, composition 302 or 304, annealed stainless steel, 12 gauge (2.68 mm).
   5. Hook Hangers for Suspended Luminaires: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug. Hook hanger shall include safety latch.

B. Motion Sensing Devices:
   1. RAB STL200:
      a. Voltage: 120V AC, 60Hz
      b. Switch Capacity: 1000 watts incandescent at 120V.
      c. Detection: 200° view.
      d. Photoelectric Control:
         (1) Deactivates lighting during daylight. Fully adjustable for custom application.
      e. UL Listed for wet locations.
      f. 6000V Surge Protected.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify that field measurements are as shown on the drawings.
B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
C. Verify that suitable support frames are installed where required.
D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION:

A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION:

A. Coordinate locations of outlet boxes provided under SECTION 26 05 33 – Raceways, Boxes, Seals, and Fittings for Electrical Systems as required for installation of luminaires provided under this SECTION.
B. Install products according to manufacturer's instructions.
C. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and making repairs.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100% of luminaire weight and vertical force of 400% of luminaire weight.

E. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet (1.2 m) between supports.
4. Install canopies tight to mounting surface.
5. Where longer than 48 inches (1200 mm), brace to limit swinging.
6. Unless otherwise indicated, support pendants from swivel hangers.
7. Provide damping of luminaire oscillations where needed.
8. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.

F. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
1. Attach luminaire per manufacturer's recommendations.
2. Do not attach luminaires directly to gypsum board.

G. Corrosion Protection:
1. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
2. Steel Conduits: Comply with SECTION 26 05 33 – Raceways, Boxes, Seals and Fittings for Electrical Systems.

H. Install accessories furnished with each luminaire.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

J. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.

K. Emergency Drivers:
1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.
2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal driver(s) in luminaire. Bypass local switches, contactors, or other lighting controls.
3. Install lock-on device on branch circuit breaker serving units.

L. Burn-In: Operate luminaires at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace luminaires that fail prematurely due to improper burn-in.

3.04 FIELD QUALITY CONTROL:

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs, emergency lighting units, and emergency drivers to verify proper operation upon loss of normal power supply.

D. Verify operation of photoelectric controls.
E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy drivers as determined by Engineer.
F. Measure illumination levels at night with calibrated meters to verify conformance with performance requirements. Record test results in written report to be included with submittals.
   1. Test according to IESNA LM-64 (parking areas).
G. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.05 ADJUSTING:
A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.
B. Aim and position adjustable emergency lighting units to achieve optimum illumination of egress path as required or as directed by Engineer or authority having jurisdiction.
C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Engineer or authority having jurisdiction.
D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this Work may be required during hours of darkness.

3.06 CLEANING:
A. Clean surfaces according to NECA 500 (commercial lighting), NECA 501 (exterior lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES:
A. See SECTION 01200 – Contract Closeout for closeout submittals.
B. Demonstration: Demonstrate proper operation of luminaires to Engineer, and correct deficiencies or make adjustments as directed.
C. Just prior to Substantial Completion, replace all luminaires that have failed.

3.08 PROTECTION:
A. Protect installed luminaires from subsequent construction operations.

3.09 BASIS OF PAYMENT
A. See SECTION 26 00 00 - General Electrical Requirements for lump sum payment.

END OF SECTION 26 50 00

DIVISION 28

FIRE ALARM SYSTEMS

SUNRISE
ENGINEERING

SECTION 28 31 00 - FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. Furnish all labor, materials, and equipment for a fully operational fire alarm system in full compliance with the applicable NFPA standards and all other codes, regulations, and laws applicable to the work, and in full compliance with the intent of the plans and specifications, including all work inferable from same.

B. SECTION includes:
   1. Fire alarm control unit (FACU).
   2. Initiating devices.
   3. Notification appliances.
   4. Wiring and connections.
   5. Raceway.
   6. Supervising station monitoring.
   7. Surge protective devices.
   8. System programming.
   9. System testing.

C. Pay for all necessary construction permits related to the fire alarm system.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 00 00 – General Electrical Requirements.
B. SECTION 26 05 19 – Low Voltage Conductors.
C. SECTION 26 05 26 – Grounding and Bonding for Electrical Systems.
D. SECTION 26 05 33 – Raceway and Boxes for Electrical Systems.
E. SECTION 26 05 44 – Sleeves and Seals for Electrical Raceways and Cabling.
F. SECTION 26 05 53 – Identification for Electrical Systems.
G. SECTION 26 08 10 - Electrical Testing and Maintenance
H. SECTION 26 27 26 – Wiring Devices.

1.04 REFERENCES:

A. Applicable Codes and Standards (latest edition or as adopted by local jurisdiction):
   1. IBC (International Building Code) with State and local amendments.
   2. IFC (International Fire Code) with State and local amendments.
   3. Local Codes including local policies, interpretation, and standards.
   4. Americans with Disabilities Act (ADA).
   5. FM Global (FM):
      a. FM Approvals - Approval Guide.
   6. NFPA (National Fire Protection Association):
   7. NFPA (National Fire Protection Association):
      a. NFPA 13 – Standard for the Installation of Sprinkler Systems.
      b. NFPA 70 – National Electrical Code (NEC).
      c. NFPA 72 – National Fire Alarm and Signaling Code.
      d. NFPA 170 – Standard for Fire Safety and Emergency Symbols.

8. Underwriters Laboratories (UL): Comply with provisions of UL safety standards pertaining to fire alarm systems; provide products and components which are UL-listed and labeled.
    a. Fire Protection equipment directory.
9. International Code Council (ICC)
    a. IMC (International Mechanical Code) with state and local amendments.

1.05 DEFINITIONS:

A. References to the Fire Alarm Technician in this SECTION shall mean:
    1. A qualified fire protection technician certified at Level III with the National Institute for Certification in Engineering Technologies (NICET) in Fire Alarm Systems.
B. References to the Fire Alarm Installer in this SECTION shall mean:
    1. A qualified fire protection technician certified at Level II with the National Institute for Certification in Engineering Technologies (NICET) in Fire Alarm Systems.
C. References to the Manufacturer's Authorized Representative in this SECTION shall mean:
    1. A qualified fire protection technician certified at Level III with the National Institute for Certification in Engineering Technologies (NICET) in Fire Alarm Systems, trained, experienced, and authorized by the fire alarm equipment manufacturer on the installation, programming, testing, and operation of their equipment.

1.06 PERFORMANCE REQUIREMENTS:

A. Contractor shall work with Fire Alarm System vendor to provide fire alarm system design.
B. The system shall be a complete, supervised, noncoded, analog/addressable, supervising station fire alarm system.
C. Provide fire alarm system suitable for type of occupancy as defined by the locally adopted building code and as approved by local authority having jurisdiction (AHJ).
D. Provide occupant notification using audible and visible occupant notification (horns and strobes) conforming to NFPA 72.
E. Fire alarm system design shall be provided by Contractor's registered Professional Engineer, reviewed by the Owner's Engineer and approved by AHJ.

1.07 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Shop Drawings: Prepare working plans, product data sheets, and calculations for the complete fire alarm system in accordance with the documentation requirements of NFPA 72.
    1. Employ the services of a Fire Alarm Technician to prepare, sign and certify the fire alarm system shop drawings and calculations for submittal.
C. Shop drawing submittals shall include, but not be limited to, the following:
    1. Name of protected premises, owner, and occupant (where applicable).
    2. Name of installer or contractor.
    3. Location of protected premises.
    4. Device legend in accordance with NFPA 170.
    5. Date of issue and any revisions.
    6. Scaled floor plan drawings (minimum scale of 1/8" = 1'-0") which include:
        a. Floor identification
        b. Point of compass
        c. Graphic scale
        d. All walls and doors

e. All partitions extending to within 10 percent of the ceiling height
f. Room and area descriptions
g. Equipment, device, component, and appliance locations
h. Settings of notification appliances (candela or wattage)
i. Locations of monitor/control interfaces to other systems
j. Unique address or identifier on each device and appliance
k. Locations of fire alarm primary power disconnecting means
l. System riser locations
m. Type and number of fire alarm system components, devices, and appliances on each circuit, on each floor level
n. Type and quantity of conductors and conduit (if used) for each circuit
   (1) Indicate wire and cable routing
   (2) Conduit and circuit routing
   (3) Number of wires or cables in each conduit or pathway
   (4) Conduit sizes
   (5) Unique identifier for each circuit.
o. Types of construction and details of ceiling geometries, including beams and solid joists, where automatic detection will be installed
p. Location of all supply and return air diffusers (where automatic detection is used)

7. System riser diagrams, coordinated with the floor plans, which include:
   a. General arrangement of the system in building cross-section
   b. Number of risers
   c. Type and number of circuits in each riser
   d. Type and number of system components, devices, and appliances on each circuit, on each floor or level shown in the order of connection
   e. Settings of notification appliances (candela or wattage)
   f. Unique address or identifier on each device and appliance
   g. Number of conductors for each circuit
   h. Point-to-point field wiring diagrams (riser diagram) of the entire fire alarm system showing all equipment, devices, appliances, and circuits
   i. Show devices and appliances in the correct order
   j. Show location of all tee taps where permitted
   k. Each circuit shall be provided with unique identifier
8. Control unit/equipment wiring diagrams for all equipment listed as a control unit, control unit accessory, power supply, or battery charger.
   a. All field wiring terminals with terminal identification
   b. Indicate and label all connected circuits
   c. Include unique identification of the control equipment
   d. Field connections to supervising station signaling equipment
   e. Field connections to fire safety control interfaces
9. Typical wiring details devices and appliances
10. Sequence of operations matrix
11. Interface of fire safety functions
12. Provide fire stopping details for penetration through fire barriers. Include UL System numbers for each detail.
13. Coordinate with other contractors to provide data sheets and details for items that may not be included in the Fire Alarm Contractor's contract but are necessary for review of the shop drawings such as conduit routing, penetration details, circuiting, etc.

14. Submit graphic display plan.

D. Calculations
   1. Battery calculations
   2. Voltage drop calculations

E. Product data sheets
   1. Provide product data sheets for all equipment, devices, appliances, etc. used.
      a. Outdated or poorly reproduced product data sheets will not be accepted.
   2. Product data sheets shall be annotated to indicate the exact model, configuration, finishes, and other options that will be provided.
      a. Product data sheets with multiple models, configurations and options that are not annotated will not be accepted.
   3. Submit power requirements for all equipment, devices, and appliances.
   4. Provide product data sheets for each cable and conductor type used.
   5. Information on termination types and raceway to be used.

F. The shop drawings, including resubmittals, shall be submitted as a complete submittal package including, but not limited to, shop drawings/working plans, annotated product data sheets, and calculations. Partial submittals and submittals not fully complying with the requirements and recommended practices of NFPA 72 and this specification will be returned disapproved without review.

G. Shop drawings shall be wholly generated and coordinated by the Fire Alarm Contractor. Partial or complete reproductions of the Engineer's drawings will not be accepted.

H. Shop drawings resubmittals shall be accompanied by a response letter addressing each comment in the Engineer's review of the shop drawings. Changes to the working plans shall be clouded to indicate the revised area and annotated to indicate the revision number and revision date.

I. Submit shop drawings, product data sheets, and calculations as specified in DIVISION 1 SUBMITTALS to the Engineer for review.

J. Submit shop drawings, product data sheets, and calculations to the following entities for review:

K. After receiving approval from the Engineer, submit shop drawings and calculations to the following entities for review:
   1. Owner
   2. The Owner's Insurance underwriter

L. The Fire Alarm Contractor assumes sole responsibility for purchasing equipment or beginning installation before all approvals are obtained. No change orders will be awarded due to purchasing equipment or beginning installation prior to obtaining approvals.

1.08 SUBMITTALS:

A. Submittals to be prepared in accordance with Specification 01300 and EJCDC C-700.7.16 Submittals.

B. Contractor qualifications: The Fire Alarm Contractor shall be a qualified fire alarm contractor, licensed and regularly engaged in the installation of fire alarm systems of similar size and complexity.
   1. Submit contractor qualifications and license information.

C. Designer qualifications:
   1. Submit qualifications of Fire Alarm Technician.
   2. Submit qualifications of Fire Alarm Installer.
   3. Submit qualifications of Manufacturer’s Authorized Representative.

D. Submit operations and maintenance manuals in accordance with DIVISION 1. In addition to items specified in DIVISION 1, provide documentation in accordance with the documentation requirements of NFPA 72. Include as-built drawings, product data sheets, calculations, and a copy of the site-specific software.
E. Submit all field test data per NFPA 72 and specifications.
   1. Submit NFPA 72 System Record of Completion and applicable Supplementary Records of Completion.
   2. Submit NFPA 72 System Record of Inspection and Testing and applicable Supplementary Records of Inspection and Testing.
F. Submit complete warranty information.

1.09 DELIVERY, STORAGE, AND HANDLING:
A. As specified in EJCDC C-700-7.13.

1.10 QUALITY ASSURANCE:
A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. Design and install fire alarm systems in accordance with the applicable NFPA standards, locally adopted building code, fire code, and other local policies, interpretations and standards as listed in Part 1 References.
   1. If there is a conflict between the reference codes or standards and this SECTION, it is the Contractor's responsibility to notify the Engineer in writing. The most stringent requirement, as determined by the Engineer shall apply.
C. Installer Qualifications:
   1. The Contractor for the fire alarm installation shall be a qualified fire alarm contractor, regularly engaged in the installation of fire alarm systems for a minimum of 5 years with required state and local licenses.
   2. The Contractor’s responsibilities include designing, fabricating, installing and programming the fire alarm system, and providing professional design and engineering services needed to assume engineering responsibility.
      a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports shall be by a qualified Fire Alarm Technician.
      b. The Contractor shall maintain a qualified Fire Alarm Installer on-site during installation.
      c. The Contractor shall maintain a qualified Fire Alarm Technician on-site during preliminary and final testing.
      d. The Manufacturer’s Authorized Representative shall supervise the installation, programming, preliminary testing, and final testing. The Manufacturer’s Authorized Representative shall provide the required instruction to the Owner's personnel in the system operation, maintenance, and programming.

1.11 WARRANTY:
A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 GENERAL:

A. All equipment shall be Listed by Underwriter's Laboratories and included in the latest edition of the U.L. Fire Protection Equipment directory or Approved by FM Global and listed in the FM Approvals - Approval Guide.
B. All components provided shall be listed for use with the selected system.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 MANUFACTURERS:

A. Fire alarm system control equipment, devices, appliances, components, and accessories may be provided by any manufacturer who can meet this specification.

2.03 FIRE ALARM AND DETECTION SYSTEMS:

A. General: Provide a complete analog/addressable fire alarm system and products of types, sizes, and capacities indicated, which comply with manufacturer's standard design, materials, components; constructed in accordance with published product information and as required for complete installation. Provide fire alarm and detection systems for applications indicated.
B. The fire alarm system shall provide operation of detection devices, alarm notification, local annunciation, auxiliary control functions and monitoring of fire suppression systems.
C. System Wiring and Supervision:
    1. Provide Class B initiating device circuits (IDC).
    2. Provide Class B notification appliance circuits (NAC).
    3. Provide Class B signaling line circuit (SLC).
    4. Provide circuits with a minimum Pathway Survivability Level 0.
D. Power Supplies: Provide system for operation on 120VAC power supply from the building electrical system. Fire alarm systems shall be power limited, operating on 24 VDC.
    1. Provide battery back-up as secondary power supply. Provide back-up battery and battery charger each with 20% spare capacity for future use. Design battery back-up to take over supply to system instantaneously. Provide battery with adequate capacity to be capable of operation of system for:
        a. 24 hours under normal supervisory (nonalarm) conditions and then for 5 minutes under alarm conditions.
    2. Battery capacity requirement shall be met regardless of whether an emergency power generator is provided as part of the project.
    3. The battery charger shall completely recharge batteries within 48 hours.
    4. Fire alarm equipment shall be hard wired. It is not permitted to be powered through a receptacle.
E. Spare circuit capacity:
    1. Do not load notification appliance circuits (horn/strobe) beyond 80 percent of capacity.
    2. Provide 2 spare notification appliance circuits.
    3. Provide a minimum of 25 spare device addresses.
F. Required System Features:
    1. Provide fire alarm matrix.
G. Wiring System Materials: Provide basic wiring materials which comply with SECTION 26 05 33 – Raceway And Boxes for Electrical Systems and SECTION 26 05 19 – Low Voltage Conductors and Cables.

1. Provide wire and cable in accordance with requirements of NFPA 70 and the FACU manufacturer.
2. Provide conductors which are listed and approved for fire alarm usage.
3. Conductors shall be solid except those used in circuits requiring shielding.
4. Minimum SLC conductor size shall be 18 AWG.
5. Minimum IDC conductor size shall be 18 AWG.
6. Minimum NAC conductor size shall be 16 AWG.
7. Provide shielded conductors for SLC's where recommended by the manufacturer or otherwise required due to other building systems or construction. Communications issue resulting from interference will be considered a deficient installation to be corrected at no additional cost.
8. Conduit shall be electrical metallic tubing (EMT) or rigid metal conduit (RMC) except where otherwise required by the electrical drawings and specifications.
    a. Minimum conduit size shall be ¾ inch.
    b. All conduit shall be factory finished red. Conduit that cannot be concealed and is exposed in finished areas shall be painted to match the surrounding finishes.
9. Fittings and seals shall be metallic suitable for use with the conduit type.
10. Terminal Boxes, Junction Boxes, and Covers: Provide fire alarm terminal boxes, junction boxes, and covers prefinished red. Label boxes as required by the AHJ and specifications.
11. Wiring connections shall be made at screw terminals at individual devices or using insulated barrier terminal strips. Wire nuts, spring loaded connectors, and similar devices are not permitted.

H. Fire Alarm Control Equipment (FACU, NAC, FAC):
1. Provide FACU enclosures for housing devices and circuits necessary to perform required functions. Control panels shall comply with UL 864.
2. Provide notification appliance circuit (NAC) extender panels as required by Contractor's design. NAC panels shall be by the same manufacturer as the FACU.
    a. NAC extender panels used to power notification appliances shall provide a minimum of 6 amp output.
3. Provide control panel for operation on 120VAC supply and for 24VDC (power limited) system operation with integral battery standby power source.
4. Provide a fire alarm communicator (FAC) to transmit signal to supervising station. The FAC shall have selectable reporting paths to include cellular only, IP only, or IP primary/cellular backup. Provide with 24-hour battery backup.
5. A fire alarm signal shall activate notification.
6. System shall be capable of alarm verification and positive alarm sequence.
7. FACU shall have a RS 232 or USB port for programming.
8. Enclosure: NEMA ICS 6, Type 1, enameled-steel, cabinet.
    a. Mounting: Surface.

I. Initiating Devices
1. All initiating devices shall be intelligent, addressable devices except where specifically noted otherwise.
2. Addressable Manual Fire Alarm Pull Stations: Provide manufacturer's standard construction, red enclosure, manual fire alarm pull station with the following features.
    a. Surface mounted in unfinished areas and outdoors.
    b. Outdoor units and units located in wet indoor locations shall be weatherproof.
    c. Semi-flush mounted in finished areas.

d. Addressable.
e. Non-break glass operation.
f. Double action.
g. Key operated to reset.
(1) Reset key must be the same as the FACU key.

3. Automatic Smoke Detectors: Provide manufacturer's standard construction automatic smoke detectors of the following types.
a. Addressable Photoelectric, 24VDC, spot-type, restorable, with pulsed infrared LED light source for operation on voltage indicated. Mount detectors on interchangeable type bases. Nominal sensitivity shall be 2.5%-3.5% per foot obscuration when tested per UL 268. Self-restoring detector which does not require resetting. Provide flashing LED indicator for normal operation which changes to steady on alarm condition. Detector shall comply with UL 268.

4. Automatic Smoke/Heat Combination Detectors: Provide manufacturer's standard construction automatic smoke detectors of the following types.
a. Smoke Sensor
(1) Addressable Photoelectric, 24VDC, spot-type, restorable, with pulsed infrared LED light source for operation on voltage indicated.
b. Heat Sensor shall comply with UL 251.
(1) Fixed temperature, 24VDC, spot type, restorable, 135F or higher.
(2) Rate of temperature rise, 24VDC, 15F per min., spot type, restorable.

J. Notification Appliances
1. Unless otherwise noted, provide notification appliance with the following color and lettering:
a. Fire alarm and smoke detection notification appliances: Red base and grill lettered "FIRE" in 1-inch high, white letters.

2. Horns: Provide manufacturer's standard construction, 24VDC, fire alarm horn with following features.
a. Noncoded
b. Surface mounted (with grille) in unfinished areas and outdoors. (Outdoor units shall be weatherproof).
c. Electronic Tone. Electromechanical designs are not acceptable.
d. Fire alarm and smoke detection alarm notification appliances shall produce a three-pulse temporal pattern in accordance with NFPA 72.

3. Visible Alarm Strobes: Strobe shall comply with UL 1971 except as noted otherwise. Provide manufacturer's standard construction alarm lights with the following features.
a. Fire alarm and smoke alarm notification appliances: Clear lens.
b. 24VDC Xenon or LED strobe.
c. Flash intensity, rate and duration shall comply with NFPA 72.

K. Surge Protective Devices:
1. Transient Voltage Surge Suppressors (TVSS) for use on AC power to FACU, NACs, AMPs, and FAC.
a. Series Connected
b. UL 1449 4th Edition, UL 1283

2. For use on IDC, NAC, SLC and communications circuits
a. UL 497A/497B

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas and conditions under which fire alarm systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 DELIVERY, STORAGE, AND HANDLING:

A. Handle fire alarm equipment carefully to prevent damage, breaking, and scoring. Do not install damaged equipment or components; replace with new.

B. Store fire alarm equipment in a clean, dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

3.03 GENERAL:

A. Design and provide a complete and fully operational fire alarm system

B. Equipment shall be installed and wired in accordance with this specification, project drawings and approved shop drawings.

C. Provide all new wiring, conduit, junction boxes and outlet boxes required for the system, including connections to initiating, indicating and control devices furnished by others.

D. The Fire Alarm Installer shall oversee the fire alarm installation and shall be on site during all fire alarm system work.

E. The Air Sampling Smoke Detector Technician shall oversee the air sampling smoke detector installation and shall be on site during all air sampling smoke detector work.

3.04 INSTALLATION OF BASIC WIRING SYSTEM MATERIALS:

A. Install wiring, raceways, and electrical boxes and fittings in accordance with SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS, 26 05 19 – LOW VOLTAGE CONDUCTORS, and NFPA 70.

B. Install all wiring in conduit or raceways.

1. See the Area Classification and Material Designations on electrical drawing E002 for the acceptable types of conduit or raceway in each area.

C. Support conduit in accordance with the NEC and DIVISION 26.

1. Tension only hangers are not permitted (for example, batwings).
2. Flexible conduit is permitted only where connecting to devices and appliances located on fire suppression equipment such as flow and tampers switches, solenoids, etc.; devices and appliances located in removable ceiling tiles.

D. Conceal conduit in walls or above ceilings unless otherwise indicated. Conduit may be surface mounted in unfinished areas (example: mechanical and electrical equipment rooms).

E. Route conduit to devices and appliances not mounted directly on walls or ceilings as a single pendent drop to each device or appliance from the ceiling surface above. Do not trapeze conduit across an open space.

F. Do not use fire alarm equipment as a raceway for routing power or low voltage wiring. Only wiring terminating within the equipment enclosure may be run into the enclosure.

G. Where possible, install wires and cables without splices. Make connections and splices at terminal strips in terminal boxes, cabinets or at equipment terminals. Wire nuts are prohibited.

H. Ground one end of shielding on circuits with shielded conductors.

I. Firestop all penetrations through fire barriers.

3.05 INSTALLATION OF FIRE ALARM SYSTEMS:

A. Install fire alarm system as indicated, in accordance with equipment manufacturer's written instructions and complying with applicable portions of the NEC.

B. Locate addressable devices only in conditioned spaces.

C. Manual Pull Stations:
   1. Install fire alarm manual pull stations 48 inches above finished floor (top of device).

D. Heat detectors:
   1. Install heat detectors in accordance with NFPA 72.
   2. Spacing of heat detectors shall be adjusted in accordance with NFPA 72 requirements for ceiling height and construction type.

E. Smoke Detectors:
   1. Smoke detectors shall not be installed until just prior to system testing when the site is free from abnormal dust and dirty conditions. If it is necessary to install smoke detectors prior to this time, they shall be protected from entry of dust and dirt with manufacturer supplied covers until the site is clean and free from construction dust and debris.
   2. Install smoke detectors in accordance with NFPA 72.
   3. Smoke detector spacing shall be in accordance with NFPA 72. This includes the advisory provisions in the Annex of NFPA 72 for areas with exposed solid joist and beam construction. Include reductions in detector spacing in the direction perpendicular to beams.
   4. On smooth ceilings, install detectors not over 30 feet apart in any direction.
   5. Spot type area smoke detectors shall not be installed in direct air flow and shall not be installed closer than 3 ft. from an air supply diffuser or return grill.
   6. Install ceiling mounted smoke detectors not less than 4 inches from a side wall to the near edge. Install detectors located on the wall at least 4 inches, but not more than 12 inches, below the ceiling.

F. Alarm Notification Appliances:
   1. Install notification appliances as indicated on the drawings, spaced in accordance with NFPA 72.
   2. Install wall mounted audible alarms not less than 90 inches above finished floor nor less than 6 inches below ceiling.
   3. Install wall mounted visible alarm strobes with the entire lens between 80 and 96 inches above finished floor.
   4. Mount appliances at uniform heights.
   5. Fire alarm notification appliances shall be installed flush mounted or semi-flush mounted. Appliances may be surface mounted in unfinished areas. Surface installation shall be with a factory provided back box. Flush and semi-flush installation shall mount to standard electrical hardware requiring no additional trim plate or adapter.
   6. Outdoor notification appliances shall be NEMA 4X, IP56 rated and shall be installed with suitable weatherproof back box, seals and gaskets.

G. Wiring: Wiring of fire alarm system is work of this SECTION but is not specifically detailed on drawings.
   1. Complete wiring in accordance with the NEC and the manufacturer's requirements.
   2. Consistently color code wiring throughout the system and install per manufacturer's point-to-point wiring diagram.
   3. Determine exact number of wires required for each device, appliance, and circuit. Connect each device or appliance with sufficient wiring to complete its intended operation.

4. Size all raceway per the NEC. Minimum sizes shall be as specified in this SECTION.
5. All fire alarm circuits shall be supervised. Provide end-of-line resistors where required to supervise conventional device circuits, power circuits, etc. This includes the wiring between fire alarm devices and auxiliary devices such as air handling units.
6. Install devices and appliances using power supplies, circuits and wire sizes to alleviate voltage drops which would make devices operate below the voltage limits for which they are designed. Calculate voltage drops before wire and equipment is installed.
    a. Perform voltage drop calculations for notification appliance circuits using the following criteria
        (1) Starting voltage shall be 20.4 VDC.
        (2) The current shall be the maximum current draw listed in the manufacturer's literature (UL Max current draw at 16 VDC) for the selected candela rating and sound output setting.
        (3) The wire resistance shall be the resistance for single strand, uncoated, copper conductors in Table 8 of the NEC unless the product data sheet for the conductor included in the product data submittal indicates a different value. The wire resistance shall be adjusted to account for the maximum ambient temperature anticipated.
        (4) The minimum voltage at each notification appliance shall be 16 VDC at all notification appliances.
7. Install surge suppressors on all 120 VAC power supplies to fire alarm equipment and on fire alarm circuits entering or leaving the building. Ground surge protection devices in accordance with the manufacturer's recommendations.
8. Identify all conductors with permanent markings at each device and panel.

H. Emergency Control Functions and Interfaces:
1. Provide all modules, wiring, and make final connections to equipment interfaced, controlled, or monitored by the fire alarm system. Provide modules and supervised power for interface with mechanical air handling units and dampers for automatic control of HVAC systems.
2. Connections to other systems shall be made by the suppliers of those systems.
3. Install modules a maximum of 3 feet from the controlled or monitored circuit or device. All relay contacts shall be Form C to permit interface with normally open and normally closed circuits. Install all relays in properly sized equipment enclosures.

I. Programming: Final system software configuration shall be verified in the field by the system supplier coordinating with the Engineer and the Owner. The system shall include all programming required to provide a proper functioning system as described herein.
1. Coordinate with the Owner's representative to verify the correct designation for each initiation point prior to final system programming. All final custom messages shall be as directed by Owner. Additional reprogramming of custom messages required as a result of poor coordination with the Owner's representative shall be reprogrammed at no additional cost to the Owner.
2. Program the system to function properly and according to the operational matrix.
3. Where allowed by the AHJ, program all smoke detectors for 30 second alarm verification.

3.06 INSTALLATION OF BASIC IDENTIFICATION:

A. Install electrical identification in accordance with SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS and this SECTION.

B. All junction, terminal, and pulling box covers shall be factory finished red and shall be identified in a permanent and legible manner to indicate the zone and circuit that it contains.
   1. Label the inside cover of the box.
   2. Hand lettering is not acceptable.
C. Label all system controls and equipment including remote power supplies and fire alarm communicators.
   1. Labels shall be permanent red phenolic labels with engraved white letters.
   2. Labels shall match fire alarm as-built drawings.
D. All detection and terminal devices shall be identified in a permanent and legible manner to indicate the device zone and address keyed to the posted operations and maintenance instructions.
   1. Hand lettering is not acceptable.
   2. Use labels such as:
      a. SD## (smoke detector)
      b. DSD## (duct smoke detector)
      c. MM## (monitor module)
      d. CM## (control module)
      e. RM## (relay module)
E. All notification appliances shall be identified in a permanent and legible manner to indicate the device number keyed to the posted operations and maintenance instructions.
   1. Hand lettering is not acceptable.
   2. Use labels such as:
      a. HS## (horn/strobe)
F. Provide identification signs adjacent to each hazardous materials emergency alarm notification appliance.
   1. Identification signs shall be permanent blue phenolic labels with engraved white letters with minimum 1/4-inch text height.
   2. The text of labels adjacent to hazardous material emergency alarm notification appliances shall be “HAZARDOUS MATERIAL EMERGENCY”.
G. All wiring shall be labeled at each termination and in each junction or pulling box.
   1. SLC wiring shall be labeled using the following format:
      a. Input (from previous device on SLC): “SLC from SD##” or “SLC from FACU”
      b. Output (to next device on SLC): “SLC to SD##” or “SLC to FACU”
   2. NAC wiring shall be labeled using the following format:
      a. Input (from previous device on NAC): “NAC from HS##”, “NAC from RPS#”
      b. Output (to next device on NAC): “NAC to HS##” or “NAC to RPS#”
H. Label each fire alarm control unit, power supply, and other equipment provided with 120VAC power with the panel location, number and circuit number powering the equipment.
I. Label batteries with the date of installation.

3.07 FIELD QUALITY CONTROL AND TESTING:

A. Connection and Supervision: Make connections to panel and perform all testing under the supervision of the Fire Alarm Technician.
B. Protect fire alarm devices during construction. Replace any unprotected smoke detectors.
C. All wiring shall test free from open conductors, shorts and/or crosses between conductors, and grounded conductors.

3.08 TESTING:

A. The Fire Alarm Technician shall perform all testing.

B. Participate in pre-testing between contractors for all building systems with interface with the building fire alarm system.
C. Provide all materials, equipment, and labor for testing.
   1. This includes specialized equipment such as manometers.
D. System Test and Approval:
   1. Prior to final acceptance of system, the Fire Alarm Technician shall test the system per NFPA 72 requirements. Test each manual, automatic, sensing, detecting, and alarm device.
      a. Test each circuit for open circuits, shorts, grounds, and loop resistance. Record test results of each circuit test and include in close-out submittals.
      b. All resettable smoke detection devices shall be tested with "canned smoke."
      c. Duct smoke detector testing shall include verifying pressure differential with a manometer or as recommended by the manufacturer.
      d. All water flow devices shall be tested with actual water flow.
      e. Test all HVAC and annunciator interfaces for proper operation.
      f. Correct any deficiencies prior to final acceptance testing.
      g. Submit written notification to the Engineer that the system has been pre-tested and all deficiencies have been corrected.
   2. In presence of the Authority Having Jurisdiction, Owner's Representative, and Engineer's representative, the Fire Alarm Technician shall perform acceptance testing in accordance with NFPA 72. Test each manual, automatic, sensing, detecting, and alarm device, notification appliance, emergency function, and equipment interface in accordance with NFPA 72.
   3. After being signed by the Authority Having Jurisdiction, submit a copy of test results to the Engineer, Owner, and Owner’s insurance carrier, and the Authority Having Jurisdiction. Provide a copy of the inspection record at the fire alarm control panel.
   4. The Manufacturer's Authorized Representative shall provide 8 hours of on-site training of the Owner's personnel on procedures related to start-up, shutdown, operation, troubleshooting, servicing, adjusting and preventative maintenance for the system. Provide Owner with 10 days advance notice of training. Coordinate training with DIVISION 26.

3.09 MAINTENANCE:

A. The equipment supplier shall maintain a local service organization which is available to perform testing, inspection, repair, and maintenance service on the system.

3.10 SPARE PARTS:

A. Provide a list of manufacturer-recommended spare parts and accessories for maintenance of the system. Including recommended quantities and unit prices.
B. Keys and locks for all equipment shall be identical where possible. Keys shall be identified by an appropriate number stamped on the key or on a metal tag attached thereto. If required, a key numbering chart shall be provided in each operations and maintenance manual furnished.
   1. Not less than 6 keys for each type required shall be provided.

3.11 LUMP SUM:

A. Measurement for DIVISION 28 shall be made as lump sum to include, but not be limited to, building permits, utility service applications and related installation requirements, fire alarm control panel, detection and notification appliances, related wiring, other required components.

END OF SECTION 28 31 00

DIVISION 40

PROCESS INTEGRATION

SUNRISE
ENGINEERING

DIVISION 40 – WATER AND WASTEWATER EQUIPMENT

SECTION 40 05 93 – COMMON MOTOR REQUIREMENTS FOR WATER AND WASTEWATER EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION includes the following:
   1. Motors and accessories for mechanical, process, and other equipment.
   2. Unless specified or indicated otherwise, motors 1/2-horsepower or smaller shall be single phase and motors 3/4 horsepower or larger shall be polyphase.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 26 05 26 – Grounding and Bonding for Electrical Systems.
B. SECTION 26 08 10 – Electrical Testing & Maintenance
C. SECTION 26 29 23 – Variable Frequency Motor Controllers

1.04 REFERENCE STANDARDS:

A. Applicable Standards:
   1. American National Standards Institute (ANSI).
      a. ANSI B11.19 – Performance Criteria for Safeguarding.
   2. American Bearing Manufacturers Association (ABMA).
      a. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
   3. Institute of Electrical and Electronic Engineers (IEEE).
      a. IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators.
   4. National Electrical Manufacturers Association (NEMA):
      a. NEMA MG 1 – Motors and Generators.

1.05 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Product Data: Submit the following as minimum:
   1. Nameplate information consisting of the following:
      a. Manufacturer's name and serial number.
      b. Horsepower output.
      c. Temperature rise and method indicated.
      d. Maximum ambient temperature.
      e. Rated Altitude
      f. Insulation class.
      g. Rpm at rated load.
      h. Operating frequency range.
      i. Number of poles.
      j. Number of phases.
      k. Voltage.
      l. Rated load amperes.
      m. Locked rotor amperes or code letter.

n. Service factor.
o. Power factor.
p. Maximum noise level of pump/motor unit (dBA).
q. Efficiency, determined in accordance with IEEE 112, Method B.

2. Dimensions for enclosure and shafts.
3. Weight.
4. Bearing information.
5. Schematic diagrams for motor and specified motor accessories.
6. Statement from motor manufacturer specifying the variable frequency drive requirements for the motor to meet all requirements and recommendations of NEMA MG 1 - Part 31 for all operational load and speed conditions specified and required.

C. Test and Evaluation Reports:
1. Factory test reports.
2. Field test reports.

D. Closeout Submittals: Final documentation shall include the following as minimum:
1. Operation and Maintenance Manuals including the following:
a. Operation and maintenance manuals for all components furnished.
b. Copies of all approved Product Data.
c. Copies of all approved Test Reports.
d. Warranty Information.
e. Contractor Information.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.
B. Motors shall be packaged, skidded and shipped to prevent damage during shipment.
C. Stored motors shall be environmentally protected and maintained according to manufacturer's recommendations.
D. If supplied, energize space heaters during storage to prevent condensation within the motor enclosure.

1.07 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. Factory test motors 50 Hp and over, using manufacturer's standard test process. Document test procedure and all measured values, including but not limited to, motor winding resistance, insulation resistance, and motor efficiency. Provide test results. Motors not passing shall not be shipped to the project site.

1.08 WARRANTY:

A. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Motors:
1. Baldor Electric Company.
2. General Electric Company.
3. Marathon Electric Manufacturing Corporation.
4. Reliance Electric.

5. Siemens Energy and Automation, Inc.
6. TECO-Westinghouse Motor Company.
7. U.S. Motors, Nidec Motor Corporation.
8. WEG Electric Corporation.

B. Shaft Grounding Ring:
1. AEGIS, Electro Static Technology, Division of Illinois Tool Works Inc.
2. Inpro/Seal, Waukesha Bearings Corporation.
3. Engineer approved equal.

C. Couplings:
1. Rexnord Corporation, Division of RBS Global.
2. Waldron Hartig Machinery Division, Midland Ross Corporation.
3. Engineer approved equal.

2.02 HORIZONTAL SINGLE-PHASE MOTORS:

A. Rated for 40°C ambient temperature and continuous operation.
B. Voltage: 115V or 115/230V, 60 hertz.
C. RPM: 1750 unless indicated or specified otherwise.
D. Minimum service factor of 1.15.
E. Efficiency: Shall meet the premium efficiency motor standards as defined by NEMA MG 1.
F. Permanent split capacitor designed for low starting torque loads and applications requiring silent operation.
G. Capacitor start designed for high starting torque loads.
H. Adequate to drive equipment over the full operating range without exceeding service factor.
I. Bearings as specified in HORIZONTAL POLYPHASE MOTORS (200HP AND LESS), this SECTION.
J. Totally enclosed, fan cooled for all enclosures.
K. Manufacturer shall prepare surfaces, prime, and finish paint all surfaces with manufacturer's standard coating system. Coating system and color shall be suitable for intended service.
L. Stainless steel nameplate data on enclosure with all lubrication and electrical data.

2.03 HORIZONTAL POLYPHASE MOTORS (200HP AND LESS):

A. Rated for 460-volt, 3 phase, and 60-hertz operation and operation with variable frequency drive, when indicated.
B. Squirrel cage induction type for across-the-line or reduced voltage starting, as indicated.
1. Where reduced-voltage starting is indicated or specified the motor shall have torque requirements capable of bringing up the specified load to full speed. The reduced voltage starting shall be limited to 65% of nominal.

C. NEMA Design:
1. NEMA B: Normal starting duty applications.
2. NEMA C: High starting duty applications.

D. NEMA Class F insulation.
E. When controlled by variable frequency drive motors, comply with NEMA MG 1 Part 31.
F. Efficiency: Shall meet the premium efficiency energy efficient motor standards as defined by NEMA MG 1.
G. Enclosures:
1. Totally-enclosed for outdoor service or wet areas indoors.

H. Horsepower Rating Requirements:
1. Ambient Temperature: 40C.

2. 1800 rpm unless specified or indicated otherwise.
3. Service factor of 1.15.
4. Adequate to drive equipment without using service factor except in emergency conditions.

I. Bearings:
1. Pre-lubricated ball bearings shielded to prevent entrance to foreign materials.
2. Re-lubrication fittings and flushing system.
3. Minimum L10 bearing life for continuous operation of 100,000 hours to conform to ABMA 9.

J. Sound Pressure Levels (SPL) of the motor shall not exceed the maximum levels as specified in NEMA MG 1 Table 9-1.

K. Manufacturer shall prepare surfaces, prime, and finish paint all surfaces with manufacturer's standard coating system. Coating system and color shall be suitable for intended service.

L. Stainless steel nameplate with all electrical and lubricating information.

M. See paragraph ACCESSORIES.

2.04 VERTICAL POLYPHASE MOTORS (200HP AND LESS):

A. For vertical motors larger than 200 HP, refer to Paragraph motor requirements (200 hp and larger) applying required additional characteristics as necessary.

B. Rated for 460-volt, 3 phase, 60-hertz operation and operation with variable frequency drives when indicated.

C. Squirrel cage, induction type.

D. Solid shaft design with non-reversing ratchet.

E. NEMA Design B:
1. Minimum starting torque 100% of full load.
2. Maximum torque greater than 200% of full load.
3. Maximum starting current 650% of full load.

F. NEMA Class B insulation except for installations where NEMA Class F is recommended by the manufacturer for the application.

G. Efficiency: Shall meet the premium efficiency energy efficient motor standards as defined by NEMA MG 1.

H. Shall be “Inverter Duty”, complying with NEMA MG 1 Part 31.

I. TEFC enclosure with stainless steel hardware unless specified otherwise.

J. Corro/severe duty rated for the Grinder motor

K. Motor shall be factory balanced to reduce vibration levels to meet the refined vibration standards.

L. Horsepower Rating Requirements:
1. Ambient Temperature: 40°C.
2. Temperature Rise Per Table:

Continuous Rated Motors (All Enclosures)	Class B Insulation	Class F Insulation	Class H Insulation
	Temperature Rise by Resistance - °C		
S.F. 1.0	80	105	125
S.F. 1.15	90	115	---
	Temperature Rise by Embedded Detector - °C		
S.F. 1.0	90	115	140
S.F. 1.15	100	125	---

3. Service factor of 1.15.
4. 1800 rpm unless specified or indicated otherwise.
5. Adequate to drive equipment without using service factor except in emergency conditions.

M. Bearings:
1. Designed for static and dynamic, and continuous and momentary thrusts as required by the driven equipment.
2. Grease or oil lubricated bearings with re-lubrication fittings and flushing system.
3. Antifriction or Kingsbury type.
4. Visual level indicator for oil lubricated bearings.
5. Minimum L10 bearing life for continuous operation of 100,000 hours to conform to ABMA 9.

N. Screened openings or other suitable means for safety and protection from rodents or other animals.

O. Drip covers and lifting lugs.

P. Sound Pressure Levels (SPL) of the motor shall not exceed the maximum levels as specified in NEMA MG 1 Table 9-1.

Q. Manufacturer shall prepare surfaces, prime, and finish paint all surfaces with manufacturer's standard coating system. Coating system and color shall be suitable for intended service.

R. Stainless steel nameplate with all electrical and lubrication information.

S. See paragraph ACCESSORIES.

2.05 ADDITIONAL MOTOR REQUIREMENTS (200 HP AND LARGER)

A. Apply as required for vertical motors and horizontal motors.

B. Refer to above motor paragraphs for required characteristics not listed below.

C. For vertical shaft motors used on vertical turbine pumps, provide anti-ratchet mechanism.

D. Polyphase multi-pole squire-cage induction motor.

E. Rated for 460-volt, 3 phase, and 60-hertz operation.

F. Service factor:
1. For constant speed motors 1.15.
2. For Variable speed service refer to motor requirements for Variable Speed AC drives.
1. Adequately sized to drive the connected load as indicated without using service factor except in emergency conditions.

G. Horsepower and speed rating shall be as defined in NEMA MG1 Part 20 for Large Machines.

H. Rated for 40°C ambient temperature and continuous operation.

I. Design:
1. Operating Characteristics:

a. Have high-starting torque, high-power factor, and efficiency consistent with good engineering practice.

2. Starting in-rush kVA limited to Code G.
3. Stator and rotor windings insulation shall be Class F and not to exceed Class B temperature rise by resistance while operating at rated 1.0 SF loading Additionally, all motors shall not exceed 90 deg C rise by the resistance method at service factor (1.15 SF) loading. The motor shall be rated for continuous operation at fill load and service factor load with a 40 deg C ambient. (NEMA MG 1 - 21.10).
4. Windings shall be copper.
5. Provide Epoxy VPI (vacuum pressure impregnation) of the motor windings for protection in humid and corrosive environments. Shall meet or exceed the requirements of NEMA MG1 and IEEE specifications for sealed windings.
6. Stator windings and end turn connections shall be fully braced to withstand all mechanical, electrical, and thermal stresses.
7. Motor Efficiency:
   a. Test constant speed motors in accordance with IEEE 112, Test Method B shall meet the premium efficiency standards in NEMA MG1 Table 12-12.
   b. For Variable speed service refer to motor requirements for Variable Speed AC drives.
8. Rotor shall be factory (statically and dynamically) balanced with completed windings and insulation in place to meet refined vibration standards.
9. Ambient Temperature rise: 40°C.
10. Temperature Rise Per Table:

Continuous Rated Motors (All Enclosures)	Class B Insulation	Class F Insulation	Class H Insulation
	Temperature Rise by Resistance - °C		
S.F. 1.0	80	105	125
S.F. 1.15	90	115	---
	Temperature Rise by Embedded Detector - °C		
S.F. 1.0	90	115	140
S.F. 1.15	100	125	---

11. Adequate to drive equipment without using service factor except in emergency conditions.
12. Vibration and Sound Pressure Levels (SPL) of the motor shall not exceed the maximum levels as specified in NEMA MG 1.
13. Frame made of cast iron or heavy fabricated steel of such design and proportion as to hold all motor components in proper position. Design to facilitate proper alignment to the mechanical load without any harmonic related vibration during motor operation.

J. Bearings:
1. Designed for static and dynamic, and continuous and momentary thrusts as required by the driven equipment.
2. Grease lubricated bearings shielded to prevent entrance to foreign materials
3. Re-lubrication fittings and flushing system.
4. Antifriction or Kingsbury type.

5. Minimum L10 bearing life for continuous operation of 100,000 hours to conform to ABMA 9.
6. Provide an insulated top bearing.

K. Provide motor surge protection capacitors and arrestors as recommended by the motor manufacturer.

L. Motor conduit boxes shall be oversized to permit solderless connection of external leads; properly insulated for voltage rating.

M. Motor leads permanently identified and of sufficient length to allow easy connection of external leads.

N. Include provisions for lifting the motor.

2.06 ACCESSORIES:

A. For vertical turbine pumps, provide non-reversing ratchets.

B. Provision for grounding motor frame.

C. For motors controlled by variable frequency drives, provide factory installed, maintenance free, circumferential, conductive micro-fiber shaft grounding ring to discharge shaft currents to ground. Motors rated 100HP and greater shall provide an insulated opposite drive end bearing.

D. Vibration transmitters: For motors over 75 hp or where indicated or specified.
1. 120Vac, 60 Hz powered transmitter.
2. Provide with internally-mounted accelerometer and self-powered 4-20mA analog output.
3. Provide unit with normally open contact rated a minimum of 10 Amps at 120 Vac to close on excessive motor vibration.
4. Metrix Model 440SR-2040-0000 Vibration Switch, or Engineer Approved Equal.
5. Provide four-point attachment ½" steel plate bracket on motor case for switch mounting near top of motor.

E. Temperature switches: For 5 to 50 hp motors or where indicated or specified,
1. Two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120VAC at 5 amps and 120 Vdc at 1 amp.
2. The temperature setpoint to open the contacts and protect the motors shall be based on motor design to minimize damage to the motor due to overheating.
3. A separate low voltage conduit box for the temperature element leads.

F. Winding RTDs: For 100 hp and above, or where specified or indicated.
1. The motor stator windings shall be provided with two Pt-100-ohm RTD embedded in each phase winding for high temperature protection. The RTD leads shall be terminated in an accessible junction box mounted as directed. Motor manufacturer to recommend high temperature shut down level.
2. Provide DIN-rail mount temperature monitoring relay compatible with sensor provided for remote mounting and integration into the indicated motor controls. The temperature setpoint to open the contacts and protect the motors shall be based on motor design to minimize damage to the motor due to overheating.
3. Provide sensor with sufficient length of cable to allow splicing for connection to the remote mounted temperature monitoring relay.
4. A separate low voltage conduit box for the temperature element leads.

G. Bearing RTDs: For 100 hp and above, or where specified or indicated.
1. The motor bearings shall be provided with one Pt-100-ohm RTD embedded in each bearing for high temperature protection. The RTD leads shall be terminated in an

accessible junction box mounted as directed. Motor manufacturer to recommend high temperature shut down level.

2. Provide DIN-rail mount temperature monitoring relay compatible with sensor provided for remote mounting and integration into the indicated motor controls. The temperature setpoint to open the contacts and protect the motors shall be based on motor design to minimize damage to the motor due to overheating.
3. Provide a sensor with sufficient length of cable to allow splicing for connection to the remote mounted temperature monitoring relay.
4. A separate low voltage conduit box for the temperature element leads.

H. Provide lubricants as required for factory testing, start-up, and field-testing.
I. All motor conduit boxes shall be oversized to permit solderless connection of external leads.
J. All motor leads permanently identified and of sufficient length to allow easy connection of external leads.

2.07 BELT GUARDS:

A. Fully enclose belts on both sides except where equipment forms one side.
B. Size to enclose next larger size driven pulley.
C. Two-piece construction when driven equipment and motor are on opposite sides of the belt guard.
D. Provide with tachometer holes and covers.
E. Protective guard shall conform to ANSI B11.19 – Performance Requirements for Safeguarding.

2.08 BELT DRIVES:

A. Single or multiple V-belt.
B. Rated 140% of motor horsepower.
C. Adjustable speed with maximum belt speed of 4,500 fpm.
D. Matched sets of belts on multiple belt drives.
E. Adjustable slide rail motor mounts.
F. Adjustable screw type LVP or MVP for over one groove on motors less than 50 hp.
G. Motors 50 hp and larger may be furnished with two nonadjustable motor pulleys, one for testing and for final operation.

2.09 COUPLINGS:

A. Type as required for specific application as acceptable to Engineer.
B. Protective guard shall conform to ANSI B11.19 – Performance Requirements for Safeguarding.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install to conform to manufacturer's instruction.
B. Lubricate all bearings, gears and items requiring lubrication before placing equipment in operation.

3.02 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust motors, assemblies, and associated equipment installations, including connections.

B. Field Testing:

1. Perform tests described below and per SECTION 26 08 10.
2. Provide manufacturer recommended testing prior to startup of motors.
3. Testing shall be performed in accordance with IEEE 112.
4. Measure the insulation resistance of the stator winding before applying voltage. Compare this measured value against the manufacturer's value. If there is no insulation resistance value furnished by manufacturer, use the following:

Motor Voltage	Insulation Resistance
600 volts and below	5 megohms

   a. If measured resistance values are lower than above, record room temperature and humidity and submit readings to Engineer before energizing. Dry out motors as required by accepted method of application of external heat, and do not apply voltage to motor until substandard resistance condition is corrected. Megger readings are to be one-minute duration, using a 500V megger for all motors 600V and below.

5. Prior to final equipment alignment, disconnect motor from driven equipment where necessary to check lubrication, starter, and control circuits. If motor is free of dirt and dust, rotate rotor by hand to determine that motor turns freely. Clean out motor if necessary. Apply voltage momentarily and note direction of rotation. Correct rotation if necessary. Reconnect motor to driven equipment.
6. After the motor is placed in operation, observe the motor for heating at the bearings or windings. If the motor appears to be running hot, notify Engineer.
   a. Note: General purpose motors may reach temperatures up to 176ºF with a room temperature of 104ºF.
7. Take motor full load amps readings on all phases.
8. Prepare all results and submit field testing and startup report to Engineer.

3.03 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.

B. All damaged or defective coatings shall be repaired prior to final acceptance.

C. Field Painting:

1. Touch Up:
   a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
   b. Field painting shall be performed based on manufacturer’s recommended procedures.
   c. Motor manufacturer shall furnish Contractor with an adequate quantity of touch-up paint to match the factory applied finish.

3.04 BASIS OF PAYMENT

A. See DIVISION 14581 – Vertical Turbine Booster Pump for payment.

END OF SECTION 40 05 93

ATTACHMENT

I/O LIST

Complete Tag	DESCRIPTION	Signal Type	Signal Level	Power Source	Controlled By	Description "0" Level	Description "1" Level	P&ID Drawing
ZS-001-O	OPEN POSITION - XV-001 VALVE	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-102
ZS-001-C	CLOSED POSITION - XV-001 VALVE	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-102
ZS-004-O	OPEN POSITION - XV-004 WASTE VALVE	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-101
ZS-004-C	CLOSED POSITION - XV-004 WASTE VALVE	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-101
PI-005	BOOSTER STATION SUCTION PRESSURE INDICATOR	AI	4-20mA	PS-RTU	PS-RTU	-	-	01DI-101
AI-006-CL	CHLORINE INDICATOR	AI	4-20mA	PS-RTU	PS-RTU	-	-	01DI-101
AA-006-L	CHLORINE LOW	DI	24VDC	PS-RTU	PS-RTU	N-LOW	LOW	01DI-101
ZS-007-O	OPEN POSITION - XV-007 VALVE	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-101
ZS-007-C	CLOSED POSITION - XV-007 VALVE	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-101
LA-010-H	HIGH WATER LEVEL ALARM	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
LA-011-H	HIGH WATER LEVEL ALARM	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
TA-012-H	HIGH TEMPERATURE ALARM - MAIN PUMP ROOM	AI	4-20mA	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
TA-013-H	HIGH TEMPERATURE ALARM - ELECTRICAL ROOM	AI	4-20mA	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
FI-002	WIND RIVER TANK FLOW INDICATOR	AI	4-20mA	PS-RTU	PS-RTU	-	-	01DI-102
FIQ-002	WIND RIVER TANK FLOW TOTALIZER INDICATOR	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-102
PI-003	BOOSTER STATION DISCHARGE PRESSURE INDICATOR	AI	4-20mA	PS-RTU	PS-RTU	-	-	01DI-102
ZS-103-O	OPEN POSITION - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-102
ZS-103-C	CLOSED POSITION - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-102
VA-102A-H	MOTOR VIBRATION HIGH ALARM - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-102
VA-102B-H	PUMP VIBRATION HIGH ALARM - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-102
YA-102-FLT	OVERLOAD/FAULT - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	N-FAULT	FAULT	01DI-102
YS-102-RC	RUN CONFIRM - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	RUN	N-RUN	01DI-102
YA-102-FLT	FAULT ALARM - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	N-FAULT	FAULT	01DI-102
TA-102-H	TEMPERATURE HIGH ALARM - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-102
JY-102-R	RUN COMMAND - P-102 BOOSTER PUMP 1	DO	24VDC	PS-RTU	PS-RTU	RUN	N-RUN	01DI-102
SI-102	SPEED INDICATOR - P-102 BOOSTER PUMP 1	AI	4-20mA	PS-RTU	PS-RTU	-	-	01DI-102
SC-102	SPEED CONTROL - P-102 BOOSTER PUMP 1	AO	4-20mA	PS-RTU	PS-RTU	-	-	01DI-102
HI-102-HOA	HAND/OFF/AUTO - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	AUTO	HAND	01DI-102
HI-102-ES	EMERGENCY STOP - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	N-STOP	STOP	01DI-102
PA-102A-L	PRESSURE LOW ALARM - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	N-LOW	LOW	01DI-102
PA-102B-H	PRESSURE HIGH ALARM - P-102 BOOSTER PUMP 1	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-102
ZS-203-O	OPEN POSITION - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-102
ZS-203-C	CLOSED POSITION - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-102
VA-202A-H	MOTOR VIBRATION HIGH ALARM - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-102
VA-202B-H	PUMP VIBRATION HIGH ALARM - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-102
YA-202-FLT	OVERLOAD/FAULT - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	N-FAULT	FAULT	01DI-102
YS-202-RC	RUN CONFIRM - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	RUN	N-RUN	01DI-102
YA-202-FLT	FAULT ALARM - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	N-FAULT	FAULT	01DI-102
TA-202-H	TEMPERATURE HIGH ALARM - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-102
JY-202-R	RUN COMMAND - P-202 BOOSTER PUMP 2	DO	24VDC	PS-RTU	PS-RTU	RUN	N-RUN	01DI-102
SI-202	SPEED INDICATOR - P-202 BOOSTER PUMP 2	AI	4-20mA	PS-RTU	PS-RTU	-	-	01DI-102
SC-202	SPEED CONTROL - P-202 BOOSTER PUMP 2	AO	4-20mA	PS-RTU	PS-RTU	-	-	01DI-102
HI-202-HOA	HAND/OFF/AUTO - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	AUTO	HAND	01DI-102
HI-202-ES	EMERGENCY STOP - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	N-STOP	STOP	01DI-102
PA-202A-L	PRESSURE LOW ALARM - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	N-LOW	LOW	01DI-102
PA-202B-H	PRESSURE HIGH ALARM - P-202 BOOSTER PUMP 2	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-102
ZS-303-O	OPEN POSITION - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-101
ZS-303-C	CLOSED POSITION - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-101
VA-302A-H	MOTOR VIBRATION HIGH ALARM - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
VA-302B-H	PUMP VIBRATION HIGH ALARM - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
YA-302-FLT	OVERLOAD/FAULT - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	N-FAULT	FAULT	01DI-101
YS-302-RC	RUN CONFIRM - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	RUN	N-RUN	01DI-101
YA-302-FLT	FAULT ALARM - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	N-FAULT	FAULT	01DI-101
TA-302-H	TEMPERATURE HIGH ALARM - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
JY-302-R	RUN COMMAND - P-302 BOOSTER PUMP 3	DO	24VDC	PS-RTU	PS-RTU	RUN	N-RUN	01DI-101
SI-302	SPEED INDICATOR - P-302 BOOSTER PUMP 3	AI	4-20mA	PS-RTU	PS-RTU	-	-	01DI-101
SC-302	SPEED CONTROL - P-302 BOOSTER PUMP 3	AO	4-20mA	PS-RTU	PS-RTU	-	-	01DI-101
HI-302-HOA	HAND/OFF/AUTO - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	AUTO	HAND	01DI-101
HI-302-ES	EMERGENCY STOP - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	N-STOP	STOP	01DI-101
PA-302A-L	PRESSURE LOW ALARM - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	N-LOW	LOW	01DI-101
PA-302B-H	PRESSURE HIGH ALARM - P-302 BOOSTER PUMP 3	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
ZS-403-O	OPEN POSITION - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-101
ZS-403-C	CLOSED POSITION - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	-	-	01DI-101
VA-402A-H	MOTOR VIBRATION HIGH ALARM - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
VA-402B-H	PUMP VIBRATION HIGH ALARM - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
YA-402-FLT	OVERLOAD/FAULT - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	N-FAULT	FAULT	01DI-101
YS-402-RC	RUN CONFIRM - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	RUN	N-RUN	01DI-101
YA-402-FLT	FAULT ALARM - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	N-FAULT	FAULT	01DI-101
TA-402-H	TEMPERATURE HIGH ALARM - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
JY-402-R	RUN COMMAND - P-402 BOOSTER PUMP 4	DO	24VDC	PS-RTU	PS-RTU	RUN	N-RUN	01DI-101
SI-402	SPEED INDICATOR - P-402 BOOSTER PUMP 4	AI	4-20mA	PS-RTU	PS-RTU	-	-	01DI-101
SC-402	SPEED CONTROL - P-402 BOOSTER PUMP 4	AO	4-20mA	PS-RTU	PS-RTU	-	-	01DI-101
HI-402-HOA	HAND/OFF/AUTO - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	AUTO	HAND	01DI-101
HI-402-ES	EMERGENCY STOP - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	N-STOP	STOP	01DI-101
PA-402A-L	PRESSURE LOW ALARM - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	N-LOW	LOW	01DI-101
PA-402B-H	PRESSURE HIGH ALARM - P-402 BOOSTER PUMP 4	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-101
YS-ATS1A-O	UTIL BREAKER OPEN - ATS-001	DI	24VDC	PS-RTU	PS-RTU	N-OPEN	OPEN	01DI-103
YS-ATS1B-AVL	UTIL POWER AVAIL - ATS-001	DI	24VDC	PS-RTU	PS-RTU	N-AVAILABLE	AVAILABLE	01DI-103
YS-ATS1C-PWR	ON UTIL POWER - ATS-001	DI	24VDC	PS-RTU	PS-RTU	N-ON	ON	01DI-103
YS-ATS1D-AVL	GEN POWER AVAIL - ATS-001	DI	24VDC	PS-RTU	PS-RTU	N-AVAILABLE	AVAILABLE	01DI-103

Complete Tag	DESCRIPTION	Signal Type	Signal Level	Power Source	Controlled By	Description "0" Level	Description "1" Level	P&ID Drawing
YS-ATS1E-PWR	ON GEN POWER - ATS-001	DI	24VDC	PS-RTU	PS-RTU	N-ON	ON	01DI-103
YS-ATS1F-O	GEN BREAKER OPEN - ATS-001	DI	24VDC	PS-RTU	PS-RTU	N-OPEN	OPEN	01DI-103
YA-GEN1	FAULT ALARM - GEN-001	DI	24VDC	PS-RTU	PS-RTU	N-FAULT	FAULT	01DI-103
EA-GEN1-L	BATTERY VOLTAGE LOW ALARM - GEN-001	DI	24VDC	PS-RTU	PS-RTU	N-LOW	LOW	01DI-103
TA-GEN1-H	TEMPERATURE HIGH ALARM - GEN-001	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-103
LA-GEN1-L	LOW COOLANT ALARM - GEN-001	DI	24VDC	PS-RTU	PS-RTU	N-LOW	LOW	01DI-103
PA-GEN1-L	LOW OIL PRESSURE - GEN-001	DI	24VDC	PS-RTU	PS-RTU	N-LOW	LOW	01DI-103
YA-GEN1	OVERCRANK - GEN-001	DI	24VDC	PS-RTU	PS-RTU	N-HIGH	HIGH	01DI-103
YS-GEN1	ACTIVE - LOAD BANK	DI	24VDC	PS-RTU	PS-RTU	N-ACTIVE	ACTIVE	01DI-103
YA-GEN1	FAULT ALARM - LOAD BANK	DI	24VDC	PS-RTU	PS-RTU	N-FAULT	FAULT	01DI-103
ZS-010-O	OPEN - PUMP STATION DOOR CONTACT	DI	24VDC	PS-RTU	PS-RTU	N-OPEN	OPEN	01DI-103
ZS-020A-O	OPEN - ELECTRICAL ROOM DOOR CONTACT	DI	24VDC	PS-RTU	PS-RTU	N-OPEN	OPEN	01DI-103
ZS-020B-O	OPEN - ELECTRICAL ROOM DOOR CONTACT	DI	24VDC	PS-RTU	PS-RTU	N-OPEN	OPEN	01DI-103
ZS-030-O	OPEN - PUMP STATION OVERHEAD DOOR CONTACT	DI	24VDC	PS-RTU	PS-RTU	N-OPEN	OPEN	01DI-103

DIVISION 40 – PROCESS INTEGRATION

SECTION 40 60 00 – PROCESS CONTROL AND INSTRUMENTATION – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

B. Refer to Attachment A, Scope of Work provided by Automation Instrumentation Controls (AIC).

1.03 SUMMARY:

A. This DIVISION includes instruments as specified in SECTION 40 70 00.

B. Project System Integrator, AIC, under separate contract, is responsible for providing and installing complete and programmed control panel (RTU).

C. Contractor to work with AIC to coordinate all aspects of the project necessary to make ready the project site, receive, install, wire, and connect AIC provided equipment.

D. Contractor to coordinate with AIC to complete necessary control system testing.

1.04 RELATED TECHNICAL REQUIREMENTS:

A. DIVISION 26 - Electrical.

B. SECTION 40 70 00 - Instrumentation for Process Systems

1.05 REFERENCE STANDARDS:

A. National Fire Protection Association (NFPA):

1. NFPA 70 – National Electrical Code (NEC).

B. Other standards as specified in applicable Sections.

1.06 DEFINITIONS

A. HMI – Human Machine Interface

B. OIT – Operator Interface Terminal

C. PLC – Programmable Logic Controller

D. PCS – Process Control System

E. RTU – Remote Telemetry Unit

1.07 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.

B. Product Data: Submit for each type of product specified and include the following as minimum:

1. Device list and bills of material.
2. Data sheets for all hardware and software.
3. Description of operation for control Equipment.

C. As-Built Drawings:

1. Upon completion of the project, submit final revised interconnect wiring diagrams in PDF format. Additionally, provide interconnect wiring diagrams in AutoCAD format on DVD-ROM, or other electronic format acceptable to Owner.

D. Additional submittals as specified in each applicable SECTION, this DIVISION.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

1.09 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.
B. General:
1. The System Integrator will be under a separate Contract. The Contractor is required to work with the System Integrator to furnish a fully functional system providing coordination efforts described herein.
a. 3rd Party System Integrator: Automation Instrumentation Controls

1.10 SEQUENCING AND SCHEDULING:

A. Coordinate the installation of Equipment and Materials specified in this DIVISION with construction schedule.

1.11 PROJECT SITE CONDITIONS:

A. Altitude = 6000 feet above mean sea level.
B. Minimum and maximum outdoor ambient temperature range = -20 ºF - 105ºF.
C. Minimum and maximum indoor non-conditioned temperature range = 50ºF - 110ºF.
D. Minimum and maximum indoor conditioned temperature range = 50ºF - 85ºF.
E. Maximum Outdoor Relative Humidity = 100%.
F. Seismic Factors: Refer to Structural.

1.12 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Products as specified in SECTION 40 70 00.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment and systems specified in this DIVISION.

3.02 INSTALLATION:

A. Contractor shall be responsible for all cabling terminations at instruments, control panels and devices supplied by the System Integrator. Coordinate with SI as required.

B. Refer to SECTION 26 05 19 – Low Voltage Cable for additional cable termination requirements.

3.03 FIELD QUALITY CONTROL:

A. Manufacturer's field services:
   1. As specified in each applicable SECTION, this DIVISION.
B. Field Testing:
   1. General Requirements:
      a. Conform to requirements as specified in DIVISION 1.
      b. Conduct all tests in the presence of Engineer under the supervision of Equipment manufacturer's field engineer.
      c. Notify Engineer two weeks prior to the commencement of all tests.
      d. Include all tests recommended by the Equipment manufacturer unless specifically waived by Engineer.
      e. Include all additional tests recommended by Engineer that he deems necessary because of field conditions, to determine that Equipment and Materials and systems meet requirements of Contract Documents.
      f. Be responsible for all damage to Equipment and Materials due to improper test procedures or test apparatus handling.
   2. Test Reports:
      a. Submit test reports as specified in DIVISION 1.
      b. Maintain a written record of all tests showing date, personnel making tests, equipment or material tested, tests performed, and results.

3.04 TRAINING:

A. The Contractor shall provide formal training for operators, maintenance and service personnel for Contractor provided equipment.
B. A training schedule and log shall be developed. The training schedule shall identify scheduled dates and times for all training sessions specified in this DIVISION. The training log shall identify dates for training and record training session attendees.
C. Training sessions shall be scheduled with the Owner a minimum of two weeks prior to occurrence and a training schedule shall be maintained and communicated to the Owner on a routine basis.

3.05 BASIS OF PAYMENT

A. LUMP SUM - Measurement for SECTION 40 60 00 shall be made as lump sum to include scope defined herein.

END OF SECTION 40 60 00

SECTION 40 70 00 – INSTRUMENTATION FOR PROCESS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this SECTION.

1.02 SUMMARY:

A. This SECTION includes the Contractor provided instrumentation requirements for measuring and controlling equipment.

1.03 RELATED TECHNICAL REQUIREMENTS:

A. SECTION 40 60 00 - Process Control and Instrumentation General Requirements

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. ASTM International (ASTM):
   1. ASME B16.5 – Pipe Flanges and Flanged Fittings.
C. International Society of Automation (ISA).
   1. ISA S20 – Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
D. National Electrical Manufacturers Association (NEMA).
E. Underwriter's Laboratories (UL).
F. Federal Communication Commission (FCC) – Part 15

1.05 SUBMITTALS:

A. Submittals to be prepared in accordance with SECTION 01300 and EJCDC C-700.7.16 Submittals.
B. Product Data:
   1. Specification Datasheets, Manufacturer Cut sheets and installation requirements.
C. Shop drawings
   1. Electrical and mechanical connection diagrams.
   2. Outline drawings.
D. Test and Evaluation Reports:
   1. Factory test and calibration reports.
   2. Field test and calibration reports.
E. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Operation and Maintenance Manuals including the following:
      a. Operation and maintenance manuals for all instruments furnished.
      b. Copies of all approved Product Data.
      c. Copies of all approved Test and Calibration Reports.
      d. Spare parts and supply list.
      e. Warranty Information.
      f. Subcontractor Information.
      g. Training Materials. Includes final edited training videos.

1.06 SITE CONDITIONS:

A. Refer to Specification 26 00 00.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. As specified in EJCDC C-700-7.13.

1.08 QUALITY ASSURANCE:

A. As specified in SECTION 01400 and in EJCDC C700-7.13.

1.09 PROJECT SITE CONDITIONS:

A. Refer to SECTION 26 00 00 for Site Conditions.

1.10 WARRANTY:

A. All equipment furnished under this SECTION shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after completion of startup.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.
C. The warranty shall comply with the requirements of EJCDC C-612 Warranty Bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Source Limitation: Instruments shall be supplied from a single manufacturer for each type of device for consistency throughout project.
B. Subject to compliance with requirements, provide instruments of one of the following (for each type):
    1. Instrument Tubing (Rigid & Flexible):
        a. Swagelok
        b. Parker
    2. Chlorine Analyzers:
        a. Hach Company (CL17)
    3. Flow Indicating Transmitters (FIT) (Insertion Type Electromagnetic):
        a. Flow-tronic (TORPEE-MAG, Basis of Design)
    4. Level Switches (LS*) (Flood Switch)
        a. Innovative Components (BLS-271, Basis of Design)
        b. Approved equal.
    5. Pressure Gauges
        a. Ashcroft, Inc.
        b. Engineer approved equal.
    6. Pressure Indicating Transmitters (PIT):
        a. Emerson
        b. Endress+Hauser
        c. Honeywell
        d. Yokogawa
        e. Siemens
    7. Temperature Indicating Transmitters (TIT):
        a. Emerson
        b. Endress+Hauser
        c. Honeywell
        d. Yokogawa
        e. ABB

2.02 GENERAL:

A. Provide instruments as indicated on the instrument schedule.
B. Tag all instruments with Contractors Tag number before shipping to site with stainless steel Device Tag as specified.
C. Transmitters shall have an output signal of 4 to 20 mA dc into a minimum load range of 0-600 ohms at 24Vdc, capable of HART communication protocol in accordance with the control system manufacturer to provide instrument calibration and diagnostic information.
D. All analog indicating and recording receivers shall have evenly graduated scales.
E. Provide all mounting brackets, pipe stands and accessories required to install all field mounted instruments. All mounting brackets and hardware for instruments installed in exterior locations or within process areas shall be stainless steel.
F. Furnish and install all accessories required for complete and working systems as specified and indicated.
G. All flanged instruments shall comply with ASME B16.5.
H. Where 4-wire instruments require external power, the instrument shall be powered from 120 VAC UPS power from control panels as specified in the SECTION 40 67 00.
I. Provide LCD displays for all transmitters.
J. Provide transient protection terminal blocks for all outdoor located equipment when available.

2.03 DEVICE TAGGING:

A. Device tags shall be stainless steel minimum 0.040-inch thickness with correct Contractor tag number and service description stamped, engraved, or laser etched clearly into the metal.
B. Device tags shall be permanently attached with minimum 18-gage stainless-steel wire to the stem or case of each Instrument, use of string or tape is unacceptable.
C. The Contractor’s tag number and service description is listed in the Instrument Schedule.
D. Provide device tag for each device furnished by this Contract prior to shipment.
E. Provide and attach a device tag to all devices received that do not have a device tag, whether furnished by this Contract or by others, and as directed by the Contractor.

2.04 FLEXIBLE INSTRUMENT TUBING:

A. Flexible instrument tubing shall be corrugated hose braided and reinforced, with permanently attached male nominal pipe thread ends.
B. Manufacturer, Product:
C. Braid: 316 or 321 stainless steel.
D. Fittings: 316 stainless steel.
E. Length: Nominally 36 inches unless otherwise specified.

2.05 CHLORINE ANALYZER:

A. The chlorine analyzer shall employ a DPD colorimetric method of measurement using DPD indicator and a buffer solution.
B. The analyzer shall be capable of measuring free or total residual chlorine by changing the indicator and buffer solutions.
C. A measurement shall be taken every 2.5 minutes and results displayed by a three-digit LCD readout in the range of 0 to 5 mg/L.
D. The analyzer shall be designed for 30-days unattended operation.
E. The analyzer shall operate with an LED light source with a peak wavelength of 510 nm.
F. The instrument shall measure a sample blank before each sample measurement to provide automatic zero reference to compensate for sample color and turbidity and changes in light intensity due to voltage fluctuations or light source aging.

G. The instrument shall provide a minimum detection limit of 0.035 mg/L or better, precision better than ± 5% or 0.005 mg/L as Cl2, and accuracy better than ± 5% or 0.035 mg/L as Cl2.
H. The analyzer shall be microprocessor-controlled and provide a 4-20 mA analog signal.
I. The microprocessor shall provide self-diagnostic functions accessible through an alphanumeric, menu-driven keyboard.
J. Analog output span minimum and maximum values shall be operator programmable at the menu-driven keypad over the entire operating range.
K. The chlorine analyzer shall be housed in an IP-62 rated, ABS plastic enclosure designed for wall mounting.
L. The enclosure shall have two clear polycarbonate windows for viewing the measurement readout and reagent levels.
M. 1/4-inch sample connection and 1/2-inch drain connection.
N. Operate from 120V, 60 hertz. Provide with cord and plug connection.
O. Accessories:
    1. Provide 1 year maintenance kit with preassembled tubing.
    2. Provide 60 days of buffer and indicator solution.
P. Hach Company Chlorine Analyzer Model CL17, or approved equal.

2.06 DIGITAL DISPLAY UNITS

A. Display units:
    1. NEMA 4X rated.
        a. Provide in NEMA 4X stainless steel enclosure maintaining the NEMA rating.
    2. Input: 4-20mA
    3. Output: 4-20mA
    4. Power Source: 24VDC, 4-20mA Loop Powered
    5. Display digits: As required for the analog process indication across the entire range of operation accurate to 2 decimals, unless the process unit is in decimals.

2.07 FLOW INDICATING TRANSMITTER

A. Flow Transmitter:
    1. Where required, provide integral mount smart digital flow transmitter.
    2. 120 VAC external power.
    3. 4-20mA output signal.
    4. IP67 rated enclosure with corrosion resistant coating.
    5. ½" NPT Cable glands.
    6. Provide dry contacts rated for 120 VAC, 1 amp
        a. Flow direction.
        b. Flow totalization.
    7. Accuracy including hysteresis, linearity, and repeatability shall be within ±0.20% of reading.
B. Electromagnetic Flow Element:
    1. Hot Tap Configuration.
    2. Flow Range: 0 to 20 feet per second, nominal.
    3. Accuracy: +/- 0.5% of reading from 0.82 ft/s to 19.68 ft/s
    4. Sensor Body: 316 Stainless Steel, with Graphite sensor electrodes
    5. Insertion Hardware: 316 Stainless Steel
    6. Sized per the process line indicated on the P&ID.
    7. Silicone rubber (EPDM) compression seal.
    8. IP68 rated corrosion resistant coating.

9. Coating shall be EPDM, PFA + or Contractor approved equal.
10. Ground per manufacturer.

2.08 LEVEL SWITCHES (FLOOD)

A. Float actuated switch.
B. The switch rating shall be at least 0.2 A at 120 VAC and 1A at 24 VDC.
C. Switch set point shall be 2" from floor.
D. Provided with 6' integral cable.
E. Provided with integral wall mount bracket.
F. Mercury switch type switches are not allowed.

2.09 PRESSURE GAUGES

A. Glycerin filled with built-in pressure snubber
B. 4.5-inch minimum diameter face.
C. Rotary gauge style in turret style phenolic case.
D. 0.25-inch NPT process connection on bottom of gauge.
E. Range shall match the pressure switch or pressure transmitter with which the gauge is installed. See P&ID drawings for paired devices and instrument list for ranges.
F. Graduations shall be in psi and feet of water.
G. Ashcroft Model 1279ASL or engineer approved equal.

2.10 PRESSURE OR DIFFERENTIAL PRESSURE INDICATING TRANSMITTERS:

A. Electronic, two-wire type with a 4-20mA output and integral LCD display.
B. Aluminum body with stainless steel wetted parts.
C. Sensor fill fluid shall be silicone oil.
D. Measuring element shall be isolation diaphragm type.
E. Accuracy including hysteresis, linearity, and repeatability shall be within ±0.20% of reading.
F. Provide zero, span, and damping adjustments. Zero adjustment shall be external.
G. Zero suppression or elevation shall be adjustable to a minimum of 100% of calibrated span.
H. Enclosure shall be NEMA 4X or equivalent IP rating in epoxy coated aluminum.
I. Pressure sensing instrument accessories as specified or indicated.

2.11 PRESSURE-SENSING INSTRUMENT ACCESSORIES:

A. General:
   1. Pressure-sensing instrument accessories are required to complete the installation of pressure-sensing instruments.
   2. Install per manufacturers recommendations.
B. Diaphragm Seal:
   1. General:
      a. Factory assemble pressure device to diaphragm seal, evacuate and fill with fill fluid into the complete unit.
      b. For every flushing connection furnish plug in same material as flushing ring.
   2. For Pressure Gauges:
      a. For threaded pipe connection use Ashcroft 101 diaphragm seal 1/2 inch NPT with 316 stainless-steel diaphragm, top housing and flushing ring.
   3. For Pressure Transmitters, as indicated on the P&IDs:
      a. Provide transmitter assembled to 1199 diaphragm seal (S1) on high side, fill with DC 200 Silicone, 20FT of 0.04-inch armored sleeve, ANSI B16.5 with 1/2-inch NPT Connection, 2,500 lb. Rating, 316 SS Upper, Lower housing, diaphragm and

plugs, two 1/4-inch flushing connections. Model number 1199 W D C 15 Threaded Seal A RTW 3 0 DA A 3 4 G.

b. Provide transmitter assembled to 1199 diaphragm seal (S1) on high side, fill with DC 200 Silicone, 20FT of 0.04-inch armored sleeve, 2-inch ANSI B16.5 SS Flange, Flushed Surface, Hastelloy C Diaphragm, lower housing and plugs, 316 SST upper housing. Model number 1199 W D C 15 Flanged Seal A FFW G 1 DB B 3 D.

c. Provide transmitter assembled to Red Valve Pressure Sensor Series 40 annular diaphragm seal with 316 SS ANSI B16.5 flange installation fill with Ethylene glycol and water fill fluid.

2.12 TUBING:

A. General:
1. Tubing shall be:
2. Seamless fully annealed and suitable for bending.
3. Stainless-steel ASTM A269 or A213 min or average wall tubing.
4. Hardness not greater than Rockwell B90.
5. 1/2-inch OD with 0.049-inch wall thickness, Grade TP316.

2.13 TUBING FITTINGS:

A. All tubing fittings provided by this Contract shall be by the same manufacturer.
B. Grip type flareless tubing fittings shall be one of the following:
1. Swagelok.
C. Parker A-lok.

2.14 INSTRUMENT SHUTOFF AND BLOWDOWN VALVES:

A. General:
1. Body sizes: Same as connecting tubing or piping.
2. End connections:
a. Tubing systems: Use integral tube fittings or adapter tubing fittings. Fittings shall be as specified in this SECTION PART 2 - TUBING FITTINGS.
b. Piping systems: Match respective process pipe line or 316 stainless steel.
3. Type: Ball valve.
4. Body: Bronze, rated 400 psig at 150ºF.
5. Packing: Reinforced Teflon.
6. Seats: Reinforced Teflon.
7. Trim: 316 stainless-steel ball and stem.
8. End Connections: 1/2-inch FNPT.
9. Manufacturer, Product:
a. Apollo, Series 70-100.
b. Nibco, Series 580 and 585.

2.15 INSTRUMENT MANIFOLD VALVES:

A. General:
1. Shop or field fabrication of manifold instrument valves using individual instrument valves and tubing or piping is not acceptable.
2. Include all necessary flange bolts and flange seals.
3. Provide 2-inch pipe mounting bracket.
4. Provide metal to metal seats.

5. Include plugged test connection on each process sensing line for calibration without removing manifold instrument valve.
6. Furnish with 1/4-inch stainless-steel plugs for test connections.
7. Body: 316 stainless steel.
8. Packing: PTFE
9. Trim: Stainless steel.
10. Connections: 1/2-inch FNPT.
11. Manufacturer, Product:
    a. Anderson Greenwood & Co.
    b. Swagelok.
    c. Parker.

2.16 TEMPERATURE TRANSMITTERS:

A. Provide for monitoring air temperature of electrical room.
B. Provide loop powered temperature transmitter for monitoring air temperature .
C. NEMA 12 aluminum housing with LCD display.
D. Provide 4-20mA analog signal proportional to temperature.
E. Suitable for wall mounting.
F. RTD sensing element.
G. Provide compact stainless steel sensing element when used for ambient air sensing applications.

PART 3 - EXECUTION

3.01 GENERAL:

A. Perform all Work necessary to install, connect, tube, wire, pipe and calibrate:
    1. In strict accordance with the manufacturer's recommendations.
    2. To make instruments and controls ready for successful operation.
    3. As specified and indicated on the instrument schedule and the Instrument Installation Details included on the Process and Instrumentation diagrams (P&IDs), and Electrical Plan Drawings.
B. Provide all material to mount on floor or wall.
C. Mount instrument plumb and level.
D. Mount instrument four feet above floor unless indicated otherwise and instrument case spaced at least 1/2-inch away from wall.
E. Provide all equipment, materials, scaffolding, rigging, and tools to complete the Work.
F. Provide all labor, including expert and common, specialized personnel, fitters, electricians, instrument technicians, and attendance of such personnel.
G. Coordinate all installation activities involving others. Identify restraints caused by others which affect performance of the Work. Resolve such restraints where possible, and notify the Engineer when additional action is required to complete the Work.
H. Electrical Plan Drawings shall be used to determine approximate location of instruments to be installed and their sensing line connections. Subcontractor shall advise the Contractor of interferences.
I. Instruments not indicated on the Electrical Plan Drawings but listed in the Instrument schedule, shall be field located by the Subcontractor with the assistance of the Contractor.
J. Install device tags for all devices without tags or as directed by the Contractor.
K. Apply lubricant to threads of screwed transmitter covers prior to installation.

3.02 TUBING AND PIPING:

A. Fabricate and erect each sensing line from the root valve to the instrument, including tubing, piping, fittings and supports for each device.

B. Tubing and piping arrangements shall be as indicated. Install offsets, fittings, unions, vents, drains, and supports to make a complete installation.

C. Install unions or flanges for each instrument or control device to allow convenient removal as follows:
   1. Install so lines may be broken for maintenance, valves removed and equipment disconnected.
   2. Install in lines erected without such unions or flanges but, in the opinion of the Contractor, cannot be properly maintained without them.
   3. Install flanges with bolt insulator kits or dielectric insulated unions for joining dissimilar piping materials, such as copper to iron or steel. Install such insulating devices in positions which receive axial loads only with no bending loads.

D. Support tubing as follows:
   1. Support individual copper tubing continuously along the entire length.
   2. Support stainless-steel tubing either continuously or from individual supports with spacing not to exceed the following distances:
      a. For 1/4-inch OD tubing, use 3 feet maximum spacing.
      b. For 3/8-inch OD tubing, use 4 feet maximum spacing.
      c. For 1/2-inch OD tubing, use 5 feet maximum spacing.
   3. Supports shall allow for thermal expansion of tubing and equipment.
   4. Provide vibration isolating materials, which in the opinion of the Contractor are required to prevent tube surface damage due to rubbing on supports.

E. Tubing and piping shall be installed either perpendicular to or parallel, to the building structure, the floor or the major equipment.

F. Tubing and piping shall be installed with a minimum clearance of 7 ft.-6 inches over passageways and walkways.

G. Verify tube fitting pull-up with the manufacturer's gap inspection gage.

H. Clean and blow out all tubing with compressed air prior to connecting to instruments.

I. Verify that the tubing systems are tight and do not leak. Repair all leaks found.

J. Install flexible instrument tubing in sensing lines where substantial relative movement occurs between the instrument and the process connection. Install where required and directed by the Contractor. Flexible tubing end connections shall be installed in the same plane and free from all torsion effects during service conditions and non-operating periods.

3.03 VALVES IN TUBING:

A. Install Instrument Shutoff Valve or Instrument Manifold Valve for each device as indicated on the Instrument Installation Details. Type of valve shall be as indicated on the Instrument Installation Details.

B. Install Instrument Manifold Valve for the sensing lines to each differential pressure device.

C. Install blowdown valves for each remote-mounted devices as indicated on the Instrument Installation Details. Type and quantity of valves shall be as indicated on the Instrument Installation Details.

3.04 INSTRUMENT STANDS:

A. Install Instrument Stands with mounting plates, floor stands, brackets, and supports to provide rigid installation.

B. Freestanding Instrument Stands shall be suitably braced and attached to the floor or supporting structure to provide a rigid mounting structure for the instruments.
C. Provide one inch of grout under concrete floor mounted instrument stands.
D. Instrument Stands and other mountings in platform grating areas shall be attached to structural steel or rigid structures. For instrument stands on platforms, weld base plates to building steel.
E. Furnish all anchors, channels, brackets, and supports for a secure, rigid, and complete installation for the Instrument Stands and installed instruments. Do not support Instrument Stands from grating or handrails.
F. Mounting plates and miscellaneous supports shall be attached to structural steel or rigid structures.
G. Instruments shall be mounted such that they are protected from physical damage, weather, heat, and vibration.
H. Instruments shall be mounted to provide easy access for calibration, repair, disconnection, removal, and replacement.
I. Mount Instrument Blowdown Valves to the Instrument Stand with mounting plates, brackets, and clips.

3.05 INSTRUMENT ENCLOSURES:

A. Instrument Enclosures or sun shields shall be furnished for instruments located outdoors.
B. Instrument Enclosures or sun shields shall be rigidly mounted to Instrument Stands.

3.06 GROUT:

A. Provide one inch of grout under concrete floor mounted supports.
B. Provide grout as indicated on the Instrument Installation Details.
C. Material shall be as specified in DIVISION 3.

3.07 PRESSURE-SENSING INSTRUMENT ACCESSORIES:

A. Install pulsation dampeners on all line-mounted pressure-sensing instruments where:
    1. Process fluid pulsing is detected.
    2. The instrument measures a pump's discharge pressure.
    3. Install siphon tubes on all line mounted steam pressure sensing instruments where the instrument is mounted above the process connection.

3.08 TEMPORARY INSTRUMENTATION:

A. Furnish temporary gauges for pressure and temperature measurement during piping system flushes and hydrostatic testing.
B. No permanent instrumentation shall be in service at this time.

3.09 TESTING:

1. Leak Testing of Tubing Systems: Initial service leak testing shall be performed on all sensing and signal line tubing systems. This includes all tubing, piping, instrument shutoff valves, manifold valves, and blowdown valves, located after the root valve. Repair any leaks found.

3.10 DEVICE CALIBRATION:

A. General:
    1. Industry standards and manufacturers' recommendations shall be followed in the execution of this Work.

2. Whenever possible, devices shall be calibrated prior to installation according to the calibration procedures specified below.
3. Provide all test instruments, calibration standards, and devices required to perform calibration and testing procedures. Alternative test equipment must be approved by the Contractor.
4. Instrument calibration shall be witnessed by the Owner, Contractor or any other person assigned by the Owner or Contractor. Provide to the Contractor daily calibration Work schedule.
5. Coordinate the Work with others so that calibration is completed prior to equipment startup or system turnover dates or as directed by the Contractor.
6. Calibrate in strict accordance with manufacturers' recommendations. Instruction books are available from the Contractor for instruments furnished by others.
7. Power all transmitters from system power supplies for calibration. Allow manufacturer's recommended warm up time prior to start of calibration of device. Use of portable power supplies or batteries to power transmitters for Device Calibration is not allowed.
8. Calibrate all instruments to the calibration ranges and set points specified on the respective instrument datasheets or as indicated on vendor drawings.
9. If the instrument is of the "smart" family, verify the internal configuration data is as specified on the respective instrument datasheet.
10. Immediately after Device Calibration, attach a calibration label or self-adhesive calibration sticker to the device with the name of the person performing the calibration and date of calibration.
11. When devices are removed from equipment, ensure the connection is protected from contamination. Clean devices such that reinsertion or installation of the device does not contaminate the equipment.
12. Report defective equipment to the Contractor.
13. Assist and cooperate with Contractor at all times through the calibration of the instruments to insure that such activities do not interfere with the planned operation of the facility.

B. Pressure or differential pressure devices:
   1. All pressure devices shall be calibrated to read the pressure at the process root valve.
   2. If pressure device does not have a Q4 calibration sheet:
      a. Use certified dead weight tester, manometer or Wallace and Tiernan pneumatic calibration unit to validate all certified calibration pressure gauges used in the calibration of all other non-calibrated devices.
      b. Adjust zero and span of device to read the pressure at the process root valve.
      c. Use a vacuum or pressure hand pump and certified calibration pressure gauge to verify and record device pressure output readings at 0, 25, 50, 75, and 100% of input value.
      d. Record alarm point and failed sensor values.
      e. Record device hysteresis.
      f. Remove test equipment and verify that the instrument output reads the correct pressure.
   3. A device provided with a factory calibration sheet can be considered calibrated unless it is in a service with a static liquid leg or similar application, calibrate the device with the procedure outline above to provide appropriate static liquid correction so zero is measured at the root valve.

C. Temperature devices:

1. Thermocouples and extension lead wire shall be checked for proper type polarity and grounding. The temperature element will be check with an ohm meter for continuity. Record the resistance
2. RTD wiring shall be checked for proper type polarity and grounding. The temperature element will be check with an ohm meter for continuity. Record the resistance.
3. Temperature switches shall be checked by immersion in a temperature regulated oven or bath. Record actuation point and any dead ban.

D. Level controllers and liquid level switches:
1. Fill the float chamber with water observe the operation of the device.
2. Lift float switches to activation point.
3. Record the controller output over the entire range of the input, verify the correct controller response or the activation of the switch occurs at the level setpoint specified.

E. Switches, other than liquid level:
1. All switch positioning shall account for dimensional changes that may occur when the equipment is placed in service.
2. Apply process input and adjust switch actuation points to specified value.
3. Record if switches make and break with an electrical continuity check.
4. Adjust dead band if applicable.
5. Verify repeatability of switch actuation points after adjustments are completed.

F. Other transmitters and signal converters:
1. Apply power, input signal, and process input, as applicable.
2. Adjust zero and span.
3. Calibrate per manufacturer instructions for the applicable process measurement.

G. Motor operated valves:
1. Apply power to the motor.
2. Use the control system to stroke the valve.
3. Record valve position over the entire input signal range; confirm whether valve is direct acting or indirect acting as required by the application.
4. Record readings or output of device at 0, 25, 50, 75, and 100% of input value.
5. Record device hysteresis.
6. Adjust limit switches to actuate at values indicated. Confirm switches make or break with an electrical continuity check.
7. Apply power to the position transmitter and adjust zero and span to represent 0 to 100% open position of the control valve.

H. Magnetic flow meters:
1. Apply power and allow the manufacturer's recommended warm-up time.
2. With a HART Communicator calibrate the meter using the manufacturers recommended procedure.

I. Receiving devices, including recorders and indicators:
1. Apply applicable electrical or pneumatic input signals and power.
2. Adjust zero and span for reach range.
3. Record readings or output of device at 0, 25, 50, 75, and 100% of input value.

3.11 INSTALLATION VERIFICATION:

A. Confirm that the instrument is mounted as indicated on the installation details and P&IDs.

B. Confirm the sensing lines are:
1. Connected to the proper pipeline, vessel or other equipment.
2. Connected to the proper instrument connections, hi side or low side.

3. Installed and adequately sloped in the appropriate direction with no pockets that would trap process material.

C. Confirm that the installation is properly supported, and there is no excessive vibration.
D. Confirm that level measuring devices are installed at the proper elevation.
E. Confirm that instrument air supplies are properly connected and adjusted to the correct pressure.
F. Confirm that signal lines are properly connected to the correct receiving device.
G. Confirm instrument is rated for electrical power run to the device and that it is correctly terminated.

3.12 LOOP TESTING:

A. General:
1. Coordinate with the Contractor and operator for the for all loop testing activities.
2. After Device Calibration and Verification of Installation has been completed for all devices in a loop, perform Loop Testing to functionally check all signals and devices within the loop display and operate correctly from the PCS. Loop Testing shall be performed on all control loops.
3. Verify operation of each instrument relative to transmitting and receiving devices in the loop.
4. Verify calibration of each instrument within the loop.
5. Verify performance of instruments that are part of electrical control schemes in order to assist the Equipment manufacturer's service representative or Contractor to functionally test the schemes.
6. Recalibrate, replace, or repair all of the loop devices as required to obtain the stated accuracy.

B. Modulating Loops:
1. Apply process input as specified in this SECTION PART 3 - DEVICE CALIBRATION or for smart transmitters manually control the output of the loop primary sensing device. Set the process to 50% of range and verify whether the loop is direct acting or indirect acting as required by the application.
2. Apply process values equal to 0, 25, 50, 75, and 100% of range of primary sensing device. Record readings of all receiving devices at each of these input values. Also record value of primary sensing device output signal at each point.
3. Adjust receiving device and transmitting device as required so that readout from receiving devices is within 1% of the value of the process input.
4. Verify that the direction of response is consistent with the control system output.
5. For output signal values of 0, 25, 50, 75, 100% from the control system, record the loop final element position in percent or degrees open.
6. If loop contains a signal converter device, such as an I/P converter, record for each output signal value from the faceplate control station the value of the input and output signals of the converter.
7. For control valve positioner or I/P converter recalibrate to obtain desired relationship between faceplate control station output and control valve position.
8. Make adjustments as required to the control drive linkage, for control drive or I/P converter recalibrate to obtain desired relationship between faceplate control station output and damper position.
9. For limit switches, verify that actuation point of limit switch is within 2% of the value specified. Adjust or recalibrate switch if required.
10. For modulating output signals from the control system to receiving devices:

a. Have the DCS operator place the output signal in manual.
b. Apply signal values equal to 0, 25, 50, 75, and 100% of output signal range.
c. Record readout of receiving devices for each value of input signal above.
d. Adjust or recalibrate receiving device as required so that readout of device is within 1% of input signal value.

11. For modulating loops containing transmitters, receiving devices and final control elements, proceed as follows:
    a. Loop test transmitters and receiving devices in the loop.
    b. Apply process input as specified in this SECTION PART 3 - DEVICE CALIBRATION or for smart transmitters manually control the output to loop transmitters. Verify that output of controllers is in the proper direction for process input values above and below controller set point.
    c. Verify null calibration of controllers by setting process input to set point and increasing controller reset adjustment. Adjust or calibrate controller as required so that controller output does not change under these conditions.
    d. Verify that direction of response of loop final control elements is in the direction specified for process input values above and below controller's set point.
    e. Record reading of the position of final control elements for input signal values of 0, 25, 50, 75, and 100% to these devices. Adjust or recalibrate final control device to obtain desired relationship between input signal value and final control element position.
    f. If final control devices have limit switches, verify that actuation point of limit switch is within 2% of value specified. Adjust or recalibrate switch if required.

C. Discreet Loops:
1. Functionally test electrical control schemes designed for the purpose of controlling operation of equipment, including motors, pumps, motor-operated valves, solenoid-operated pneumatic valves and similar field equipment. By performing all of the functions described below. These functions shall be performed under the coordination and supervision of the Contractor.
    a. Apply process input as specified in this SECTION PART 3 - DEVICE CALIBRATION.
    b. Verify that switch actuation point is within 1% of that specified. Verification of switch actuation shall be by electrical continuity test.
    c. Remove process input from instrument, when requested, and verify switch returns to "on the shelf" state.
    d. Repeat a. and b. above as required for Contractor to witness the operation from the plant PCS to complete functional test of control scheme.
    e. Verify that final control devices are interfaced to the control system operate as intended by the design of the control scheme. If final control device has limit switches, verify that these actuate within 2% of specified actuation value.
2. If a non-modulating type instrument is utilized to provide an input to the control system, perform a loop test as follows:
    a. Apply process input as specified in this SECTION PART 3 - DEVICE CALIBRATION.
    b. Verify that actuation point of switch is within 1% of that specified and that the input is received at the terminals of the control system. Verification shall be by electrical continuity test.

3.13 TUNING:

A. After Loop Testing or during start-up of the process system or equipment, tuning adjustments are required to obtain safe and smooth control action within the range of design limits of the equipment. SI shall tune all loop, including PID controllers and constants wired to the control system.
B. Verify that the instrumentation is operating within design limits and at design point.
C. Vary the process load, and verify that the control system or instrument response is within design limits over the entire range.
D. Stroke remotely operated valves and dampers as required for loop tuning.
E. Ramp variable frequency drives through their operating range with setpoint changes as required for loop tuning.
F. Adjust controllers for optimum response. Adjust proportional band, reset, rate and set point as required to obtain safe and smooth control action within the range of design limits of the equipment.
G. Provide expert attendance and labor to manufacturer's representative for adjustments to the control system.
H. Record and submit all tuning constants to the Contractor and the Owner on the loop checkout sheets.

3.14 TESTING:

A. Cooperate and coordinate with other contracts as required when the testing of all devices, as outlined below, involves such other contracts. This shall include, but not be limited to, coordinating the following:
   1. Scheduling as directed by the Contractor.
   2. Manpower requirements, including expert and common labor, specialized personnel and supervision.
   3. All equipment and testing devices required.

3.15 BASIS OF PAYMENT

A. LUMP SUM - Measurement for SECTION 40 70 00 shall be made as lump sum to include scope defined herein.

END OF SECTION 40 70 00

REFER TO ATTACHMENT – INSTRUMENT LIST

ATTACHMENT

INSTRUMENT LIST

TAG NUMBER	DESCRIPTION	DEVICE TYPE	CONTROL POINT	SET POINT	CAL. RANGE MIN	CAL. RANGE MAX	SET POINT / CAL. RANGE UNIT	FURNISHED BY	INSTALL DETAIL	WIRED BY	ELECTRICAL DWG / SPEC.	PIDDwg	NOTES
ZS-001-O	OPEN POSITION SWITCH - XV-001	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-101	
ZS-001-C	CLOSE POSITION SWITCH - XV-001	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-101	
FIT/FE-002	WIND RIVER TANK FLOW METER TRANSMITTER	FLOW INDICATING TRANSMITTER	PS-RTU	N/A	0	15	MGD	CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-102	
FQT-002	WIND RIVER TANK FLOW TOTALIZER TRANSMITTER	FLOW TOTALIZER TRANSMITTER	PS-RTU	N/A	N/A	N/A	MG	CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-102	
PIT-003	BOOSTER STATION DISCHARGE PRESSURE TRANSMITTER	PRESSURE TRANSMITTER	PS-RTU	SEE NOTES	0	160	PSI	CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-102	COORDINATE ALARM SETPOINTS WITH OWNER
ZS-004-O	XV-004 WASTE VALVE POSITION SWTICH - OPEN	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-101	
ZS-004-C	XV-004 WASTE VALVE POSITION SWITCH - CLOSE	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-101	
PIT-005	PRESSURE TRANSMITTER - BOOSTER STATION SUCTION	PRESSURE TRANSMITTER	PS-RTU	SEE NOTES	SEE NOTES	SEE NOTES	SEE NOTES	CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-101	COORDINATE ALARM SETPOINTS WITH OWNER
AIT-006-CL	CHLORINE ANALYZER INDICATOR TRANSMITTER	ANALYZER TRANSMITTER	PS-RTU	SEE NOTES	SEE NOTES	SEE NOTES	SEE NOTES	CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-101	COORDINATE ALARM SETPOINTS WITH OWNER
ZS-007-O	OPEN POSITION SWITCH - XV-007	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-101	
ZS-007-C	CLOSE POSITION SWITCH - XV-007	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-101	
LS-010-H	HIGH WATER LEVEL SWITCH	LEV EL SWITCH	PS-RTU	SEE NOTES	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-101	2" ABOVE FNISHED FLOOR
ZS-010-O	OPEN DOOR CONTACT - PUMP STATION DOOR	DOOR CONTACT	PS-RTU	N/A	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-103	
LS-011-H	HIGH WATER LEVEL SWITCH	LEV EL SWITCH	PS-RTU	SEE NOTES	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-101	2" ABOVE FNISHED FLOOR
TIT-012	TEMPERATURE - MAIN PUMP ROOM	TEMPERATURE TRANSMITTER	PS-RTU	92	32	122	F	CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-101	
TIT-013	TEMPERATURE - ELECTRICAL ROOM	TEMPERATURE TRANSMITTER	PS-RTU	92	32	122	F	CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-101	
ZS-020A-O	OPEN DOOR CONTACT - ELECTRICAL ROOM DOOR	DOOR CONTACT	PS-RTU	N/A	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-103	
ZS-020B-O	OPEN DOOR CONTACT - ELECTRICAL ROOM DOOR	DOOR CONTACT	PS-RTU	N/A	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-103	
ZS-030-O	OPEN DOOR CONTACT - PUMP STATION OVERHEAD DOOR	DOOR CONTACT	PS-RTU	N/A	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-103	
PS-102A-L	PRESSURE SWITCH LOW - P-102 BOOSTER PUMP 1	PRESSURE SWITCH	PS-RTU					CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-103	
PS-102B-H	PRESSURE SWITCH HIGH - P-102 BOOSTER PUMP 1	PRESSURE SWITCH	PS-RTU					CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-103	
VT-102A-MTR	MOTOR VIBRATION TRANSMITTER - P-102 BOOSTER PUMP 1	VIBRATION TRANSMITTER	PS-RTU	SEE NOTES	SEE NOTES	SEE NOTES	SEE NOTES	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	COORDINATE SETPOINTS WITH MOTOR MANUFACTURER
TE-102A1	MOTOR TEMPERATURE ELEMENT A1 - P-102 BOOSTER PUMP 1	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-102A2	MOTOR TEMPERATURE ELEMENT A2 - P-102 BOOSTER PUMP 1	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
VT-102B-PMP	PUMP VIBRATION TRANSMITTER - P-102 BOOSTER PUMP 1	VIBRATION TRANSMITTER	PS-RTU	SEE NOTES	SEE NOTES	SEE NOTES	SEE NOTES	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	COORDINATE SETPOINTS WITH MOTOR MANUFACTURER
TE-102B1	MOTOR TEMPERATURE ELEMENT B1 - P-102 BOOSTER PUMP 1	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-102B2	MOTOR TEMPERATURE ELEMENT B2- P-102 BOOSTER PUMP 1	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-102C1	MOTOR TEMPERATURE ELEMENT C1 - P-102 BOOSTER PUMP 1	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-102C2	MOTOR TEMPERATURE ELEMENT C2 - P-102 BOOSTER PUMP 1	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-102D	BEARING TEMPERATURE ELEMENT D - P-102 BOOSTER PUMP 1	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	41 05 93	01DI-103	
TE-102E	BEARING TEMPERATURE ELEMENT E - P-102 BOOSTER PUMP 1	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	42 05 93	01DI-104	
ZS-103-O	OPEN POSITION SWITCH - P-102 BOOSTER PUMP 1	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-102	
ZS-103-C	CLOSE POSITION SWITCH - P-102 BOOSTER PUMP 1	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-102	
PS-202A-L	PRESSURE SWITCH LOW - P-202 BOOSTER PUMP 2	PRESSURE SWITCH	PS-RTU					CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-103	
PS-202B-H	PRESSURE SWITCH HIGH - P-202 BOOSTER PUMP 2	PRESSURE SWITCH	PS-RTU					CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-103	
VT-202A-MTR	MOTOR VIBRATION TRANSMITTER - P-202 BOOSTER PUMP 2	VIBRATION TRANSMITTER	PS-RTU	SEE NOTES	SEE NOTES	SEE NOTES	SEE NOTES	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	COORDINATE SETPOINTS WITH MOTOR MANUFACTURER
TE-202A1	MOTOR TEMPERATURE ELEMENT A1 - P-202 BOOSTER PUMP 2	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-202A2	MOTOR TEMPERATURE ELEMENT A2 - P-202 BOOSTER PUMP 2	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
VT-202B-PMP	PUMP VIBRATION TRANSMITTER - P-202 BOOSTER PUMP 2	VIBRATION TRANSMITTER	PS-RTU	SEE NOTES	SEE NOTES	SEE NOTES	SEE NOTES	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	COORDINATE SETPOINTS WITH MOTOR MANUFACTURER
TE-202B1	MOTOR TEMPERATURE ELEMENT B1 - P-202 BOOSTER PUMP 2	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-202B2	MOTOR TEMPERATURE ELEMENT B2- P-202 BOOSTER PUMP 2	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-202C1	MOTOR TEMPERATURE ELEMENT C1 - P-202 BOOSTER PUMP 2	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-202C2	MOTOR TEMPERATURE ELEMENT C2 - P-202 BOOSTER PUMP 2	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-202D	BEARING TEMPERATURE ELEMENT D - P-102 BOOSTER PUMP 2	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	41 05 93	01DI-103	
TE-202E	BEARING TEMPERATURE ELEMENT E - P-102 BOOSTER PUMP 2	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	42 05 93	01DI-104	
ZS-203-O	OPEN POSITION SWITCH - P-202 BOOSTER PUMP 2	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-102	
ZS-203-C	CLOSE POSITION SWITCH - P-202 BOOSTER PUMP 2	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-102	
PS-302A-L	PRESSURE SWITCH LOW - P-302 BOOSTER PUMP 3	PRESSURE SWITCH	PS-RTU					CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-102	
PS-302B-H	PRESSURE SWITCH HIGH - P-302 BOOSTER PUMP 3	PRESSURE SWITCH	PS-RTU					CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-102	
VT-302A-MTR	MOTOR VIBRATION TRANSMITTER - P-302 BOOSTER PUMP 3	VIBRATION TRANSMITTER	PS-RTU	SEE NOTES	SEE NOTES	SEE NOTES	SEE NOTES	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	COORDINATE SETPOINTS WITH MOTOR MANUFACTURER
TE-302A1	MOTOR TEMPERATURE ELEMENT A1 - P-302 BOOSTER PUMP 3	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-302A2	MOTOR TEMPERATURE ELEMENT A2 - P-302 BOOSTER PUMP 3	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
VT-302B-PMP	PUMP VIBRATION TRANSMITTER - P-302 BOOSTER PUMP 3	VIBRATION TRANSMITTER	PS-RTU	SEE NOTES	SEE NOTES	SEE NOTES	SEE NOTES	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	COORDINATE SETPOINTS WITH MOTOR MANUFACTURER
TE-302B1	MOTOR TEMPERATURE ELEMENT B1 - P-302 BOOSTER PUMP 3	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-302B2	MOTOR TEMPERATURE ELEMENT B2- P-302 BOOSTER PUMP 3	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-302C1	MOTOR TEMPERATURE ELEMENT C1 - P-302 BOOSTER PUMP 3	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-302C2	MOTOR TEMPERATURE ELEMENT C2 - P-302 BOOSTER PUMP 3	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-302D	BEARING TEMPERATURE ELEMENT D - P-102 BOOSTER PUMP 3	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	41 05 93	01DI-103	
TE-302E	BEARING TEMPERATURE ELEMENT E - P-102 BOOSTER PUMP 3	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	42 05 93	01DI-104	
ZS-303-O	OPEN POSITION SWITCH - P-302 BOOSTER PUMP 3	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-102	
ZS-303-C	CLOSE POSITION SWITCH - P-302 BOOSTER PUMP 3	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-102	
PS-402A-L	PRESSURE SWITCH LOW - P-402 BOOSTER PUMP 4	PRESSURE SWITCH	PS-RTU					CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-102	
PS-402B-H	PRESSURE SWITCH HIGH - P-402 BOOSTER PUMP 4	PRESSURE SWITCH	PS-RTU					CONTRACTOR	SEE DRAWINGS	CONTRACTOR	40 70 00	01DI-102	
VT-402A-MTR	MOTOR VIBRATION TRANSMITTER - P-402 BOOSTER PUMP 4	VIBRATION TRANSMITTER	PS-RTU	SEE NOTES	SEE NOTES	SEE NOTES	SEE NOTES	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	COORDINATE SETPOINTS WITH MOTOR MANUFACTURER
TE-402A1	MOTOR TEMPERATURE ELEMENT A1 - P-402 BOOSTER PUMP 4	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-402A2	MOTOR TEMPERATURE ELEMENT A2 - P-402 BOOSTER PUMP 4	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
VT-402B-PMP	PUMP VIBRATION TRANSMITTER - P-402 BOOSTER PUMP 4	VIBRATION TRANSMITTER	PS-RTU	SEE NOTES	SEE NOTES	SEE NOTES	SEE NOTES	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	COORDINATE SETPOINTS WITH MOTOR MANUFACTURER
TE-402B1	MOTOR TEMPERATURE ELEMENT B1 - P-402 BOOSTER PUMP 4	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-402B2	MOTOR TEMPERATURE ELEMENT B2- P-402 BOOSTER PUMP 4	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-402C1	MOTOR TEMPERATURE ELEMENT C1 - P-402 BOOSTER PUMP 4	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-402C2	MOTOR TEMPERATURE ELEMENT C2 - P-402 BOOSTER PUMP 4	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	40 05 93	01DI-102	
TE-402D	BEARING TEMPERATURE ELEMENT D - P-102 BOOSTER PUMP 4	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	41 05 93	01DI-103	
TE-402E	BEARING TEMPERATURE ELEMENT E - P-102 BOOSTER PUMP 4	RTD	PS-RTU	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	BY MANUFACTURER	VENDOR	SEE DRAWINGS	VENDOR	42 05 93	01DI-104	
ZS-403-O	OPEN POSITION SWITCH - P-402 BOOSTER PUMP 4	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-102	
ZS-403-C	CLOSE POSITION SWITCH - P-402 BOOSTER PUMP 4	POSITION SWITCH	PS-RTU	BY CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	SEE DRAWINGS	CONTRACTOR		01DI-102	