GILPIN COUNTY
REQUEST FOR PROPOSAL
-RFP-

Title: Dory Lake Pump Replacement

Proposal Submittal Deadline: September 9, 2024

I. Introduction

Gilpin County was established in the state of Colorado 1861 and spans 150 square miles through the North Central Foothills of Colorado with elevations spanning from 7,110 to 13,300 feet above sea level. Gilpin County is home to approximately 6,000 residents and contains two cities - Black Hawk and Central City.

II. Background

Gilpin County operates a pump station in Dory Lake to augment Ralston Creek flows, when determined by the State Water Commission, out of Dory Lake and into nearby Ralston Creek to maintain obligations to senior water rights. The current system is at risk of failing due to the submerged pumps in Dory Lake nearing the end of their life cycle. Instead of replacing the submerged pumps in-kind, the new construction will include installing a new submerged intake to include an air backwash cleaning system to allow for cleaning without divers. Two new pumps and necessary piping will be installed along the shoreline within a premanufactured pump enclosure. The new intake from the lake will be plumbed into the premanufactured pump enclosure and the outlet will tie into the existing discharge line. Removal and upgrading of electrical fixtures will be required.

Firms with experience in pumping facilities for municipal and/or commercial infrastructure will be best suited for this project. A proposal to provide for removing the existing pumping and electrical equipment and installing intakes, piping and premanufactured pump enclosure (already purchased) will be required.

III. Scope of Work

The qualified Firm is to provide all the necessary services, labor, equipment and supplies required for the satisfactory completion as described in this RFP.

The Firm will provide services which may include, but are not limited to, the following:

The Dory Lake Pump Project consists of the construction of a new above-ground, enclosed, water pump station on the shore of Dory Lake. The pump station will tie into an existing pipeline and controls but replace the current submerged skid pump system within the lake with a water intake. The pipe leading from the intake screen to the

new pump station will be buried within the visible shoreline but will be anchored to the Lake bottom once below high water level. The Contractor will provide the following services:

- Removal of existing pumps, skid and discharge line (up to the existing proposed premanufactured enclosure)
- Removal of electrical equipment
- Installation of a concrete pad and plumbing to proposed premanufactured pump enclosure
- Installation of premanufactured pump enclosure (currently purchased and in production)
- Tie-ins to existing discharge line
- Installation of intake screen and HDPE intake piping
- Upgrade of electrical equipment to service premanufactured pump enclosure
- Protect and restore all areas of disturbance. This is a sensitive environment, and the contractor shall practice leave no trace ethics.

The Contractor is strongly encouraged to visit the site prior to bidding to observe the access to the construction site. Smaller equipment will be necessary to perform the work as tree removal is not allowed.

The Contractor shall furnish all materials, supplies, labor, services, transportation, tools, equipment, and parts for said work in strict conformity with the accompanying Contract Documents, which are attached hereto and incorporated herein by this reference, including the following:

1. Appendix A – Dory Lake Bid Schedule
2. Appendix B – Dory Lake Specifications
3. Appendix C – Dory Lake Construction Plans

In performing the work, the Firm shall use the degree of care and skill ordinarily exercised under similar circumstances by members of the same profession working in both the Denver-Boulder metropolitan area, and similar areas within the Continental US. The Contractor represents to the County that the Contractor is, and its employees performing such work are, properly licensed and/or registered within the State of Colorado for the performance of the work (if licensure and/or registration is required by applicable law) and that the Contractor and its employees possess the skills, knowledge, and abilities to competently, timely, and professionally complete the Work.

IV. Submittal Requirements

This Request for Proposal (RFP) describes the requested scope of services and information to be included in each proposal. Failure to submit information to the County in accordance with the requirements of this RFP and its procedures may be cause for disqualification. The proposal should be concise and complete, covering all items identified, emphasizing an understanding of the project and the resources to perform the intended work. Unclear, ambiguous statements such as “all reasonable effort to provide” must be avoided. Failure to address any of the requirements may be subject to rejection and/or misinterpretation. Inability to meet any specified requirements must be so stated and thoroughly explained.

Proposals are to be addressed to Ryan Keenan at rkeenan@gilpincounty.org in accordance with the Instructions to Proposers and all other requirements as referenced in this RFP. Proposals will be received until the Proposal Closing Date and Time set forth on the cover page of this RFP, at which time a representative of the County will publicly announce the names of those firms or individuals submitting proposals. No other public disclosure will be made if and until award of Contract.

The RFP Submittal shall include the following:

1. *Letter of Transmittal*

   The letter of transmittal must contain the following statements and information, and is not intended to be a summary of the proposal:

   - Company name, address, and telephone number(s) of the firm submitting the proposal.
   - Name, title, address, email address and telephone number of the contact person or persons, authorized to represent the firm and to whom to direct correspondence.
   - Taxpayer identification numbers of the firm.
   - Brief statement of your understanding of the services to be performed and a positive commitment to provide the specified services.
   - Signature of a corporate officer or other individual who is legally authorized to bind the applicant to both its proposal and cost schedule.
   - Statement which indicates "proposal and cost schedule shall be valid and binding for ninety (90) days following proposal due date and will become part of the contract that is negotiated with Gilpin County."

2. *General Vendor Information – Please provide the following:*

   - Length of time in business
   - Total number of clients
   - Number of full-time personnel
   - Location of office which would service this account

3. *Technical Proposal -*

   - Provide a detailed technical and narrative response regarding the ability to accomplish the work outlined within the Scope of Work. The Evaluation Criteria listed in the Evaluation of Proposals section below provides additional information and the criteria that evaluators will use.
   - Understanding the Proposal. Responses will include comprehensive information and narrative statements that illustrate proposer's understanding of the requirements of the project and the project schedule.
   - Methodology Used for the Proposal. Responses will include comprehensive information and narrative statements that set out the methodology they intend to employ and illustrate how the methodology will serve to accomplish the work.
   - Management Plan for the Proposal. Responses will include comprehensive information and narrative statements that set out the management plan they intend to follow and illustrate how the plan will serve to accomplish the work.
   - Experience and Qualifications. Responses will include a detailed explanation of your experience with similar projects and employees.
   - Provide a detailed narrative describing your firm's experience with a minimum of three (3) projects of similar size and scope in the past five (5) years.
     Examples of Past Projects. Responses will include at least three examples of past completed projects of reasonable similarity.
   - Provide a narrative description of the organization and capabilities of the project team and a personnel roster that identifies each person who will actually work on the contract.
   - Provide a minimum of three (3) current or former clients where work has been performed within the last five years who may be contacted with respect to your firm's reputation for high quality of work, responsibility and efficiency. Include the name, email address and telephone number of the executive in each organization who can speak knowledgeably about the quality, timeliness and cost of your work.

4. Financial/Cost Proposal –

- Submit pricing/cost information in a separate package from the technical proposal, clearly marked on the outside. Do not include costs in the technical proposal. Electronic copies of proposals will include separate files for financial and technical proposals. Separate discs or drives are not required.

- Submit a detailed cost proposal including all costs and charges for the proposed services, including any licenses, maintenance, fees, training, implementation, and any other costs required. Estimate the hours and provide cost schedule detail for any service engagements necessary to meet the goals, if appropriate. Break down the cost proposal to indicate all costs. Anticipated project length and/or time frame for work must be included.

5. Descriptive Pages and Brochures –

- All standard descriptive informational pages and brochures should be submitted in a section titled "APPENDIX."

V. Evaluation Criteria and Process

A project committee will evaluate all proposals. Proposals shall be evaluated on the basis of the Evaluation Criteria noted herein. The committee may make a selection on the basis of the proposals received, or may choose to "shortlist" prospective firms for further negotiations. The firm selected for the award will be chosen on the basis of the apparent greatest benefit to the County, and not necessarily on the basis of lowest price. Individual interviews may be required for the top firms who have submitted the required information.

Evaluation Criteria	Weight
Business/Experience	10%
Understanding the Project	20%
Methodology/Functionality	20%
Management Plan/Administration	20%
Cost	30%
TOTAL	100%

Reference checks, when conducted, will not be rated but will be considered on a "pass/fail" basis.

Following an individual rating period, the evaluation team will meet to discuss the initial rating and may choose to make an award at that time. Failure of the proposer to provide any information requested in this RFP may result in disqualification of the proposal.

THIS REQUEST FOR PROPOSAL IS NOT A COMPETITIVE BID BASED ON PRICE ONLY. The Request for Proposal allows Gilpin County to select the contractor that best meets the needs of the County, taking into consideration proposer qualifications, price, products, and service capabilities and other factors relevant to the City's policies, programs, administrative resources, and budget.

This RFP has been published at the BidNet Direct System and on the County Web Site.

Any modifications to this RFP or addenda pertaining to this RFP will be published to the BidNet Direct System and on the County Web Site, and all proposers are responsible to periodically check both System for relevant updates prior to the submittal of a proposal.

Written Inquiries – Interested applicants may make written inquiries concerning this RFP to obtain clarification of requirements or additional information. No inquiries will be accepted after the date and time of the Written Inquiry Deadline indicated in the Schedule of Activities. Send all inquiries via email, referencing the RFP number and title in the subject line, to rkeenan@gilpincounty.org.

VI. Deadline for Submission of Proposals

One electronic submission must be received by the County prior to 12:00 p.m. (noon) on September 4th, 2024. The submission must be labeled as ***"Dory Lake Pump Replacement"*** in the subject line and sent to this email address: rkeenan@gilpincounty.org. Physical submissions will not be accepted.

Schedule of Activities:

Activity	Date (all times are local time)
RFP Issued	August 19, 2024
Written Question Deadline	August 26, 2024
Responses to Written Inquiries Delivered	August 30, 2024
Proposal Submission Deadline	September 9, 2024
Anticipated Award	September 16, 2024
Anticipated Notice of Award	September 16, 2024
Project Start	October 7, 2024

VII. Miscellaneous

Gilpin County reserves the right to reject any and all proposals for failure to meet the requirements herein, to waive any technicalities, and to select the proposal which, in the County's sole judgment, best meets the requirements of the project.

The RFP creates no obligation on the part of the County to award a contract or to compensate the proposer for any costs incurred during proposal presentation, response, submission, presentation or oral interviews (if held). The County reserves the right to award a contract based upon proposals received without further discussion or negotiation. Proposers should not rely upon the opportunity to alter their qualifications during discussions.

The County further reserves the right to make such investigation as it deems necessary to determine the ability of proposers to furnish the required services, and proposers shall furnish all such information for this purpose as the County may request.

Proposers must specifically identify any portions of their submittals deemed to contain confidential or proprietary information, or trade secrets. Those portions must be readily separable from the balance of the proposal. Such designations will not necessarily be conclusive, and proposers may be required to justify why Gilpin County should not, upon written request, disclose such materials.

The County is not responsible for electronic submissions or communications not received, in any way associated with this RFP.

Contract -
Pending successful contract negotiations, one or more contracts may be awarded to the Contractor or Contractors whose proposal(s) is/are the most advantageous and offer the best overall value to the County, taking into consideration price and other evaluation factors described in this RFP. If more than one contract is awarded, an effort will be made to award work in an equitable manner taking into consideration the following criteria for each project:

- Specific area of focus / special requirements
- Cost
- Availability of the Contractor
- Prior performance of the Contractor

Appendix A – Dory Lake Bid Schedule

GILPIN COUNTY

BID FORM FOR

DORY LAKE PUMP REPLACEMENT PROJECT

NOTICE TO CONTRACTORS: YOU ARE REQUIRED TO USE THIS FORM WHEN SUBMITTING A BID.

	Description	Unit	Quantity	Unit Price	Total Cost
Division 1 - General					
1.01	Mobilization	LS	1		
1.02	"Trail Closed" Signs	EA	3		
				Division 1 Subtotal	
Division 2 - Existing Conditions					
2.01	Remove Existing Pump Skid	LS	1		
2.02	Remove Exisiting 6 inch HDPE Pipe and Electrical Conduit	LF	360		
2.03	Remove Existing Pedestal	LS	1		
2.04	Cut and Cap Existing 6 inch HDPE Pipe and Electrical Conduit	LS	1		
				Division 2 Subtotal	
Division 3 - Concrete					
3.01	RCP pipe anchor	EA	3		
3.02	Concrete Foundation and Pad	CY	3		
				Division 3 Subtotal	
22.01	6-inch 90° Elbow	EA	5		
22.02	6"x4" Reducer	EA	1		
				Division 22 Subtotal	
25.01	Control Conductors - exist LCP to new pump CP	LS	1		
				Division 25 Subtotal	
26.01	Electrical Demolition (service equipment, vault, equipment rack)	LS	1		
26.02	Electrical Service Equipment	LS	1		
26.03	Power Conduit and Conductors (incl. HH-1&2)	LS	1		
				Division 26 Subtotal	
Division 31 - Site Work					
31.01	Restoration of the Trail	LS	1		
31.02	Excavation	CY	87		
31.03	Backfill	CY	56		
31.04	Restoration of Stabilized Staging Area	SY	1,237		
31.05	Seeding	LS	1		
31.06	Construction Fence	LF	450		
31.07	Rock Socks	LF	323		
31.08	SSA - Roadway Stabilization	SY	1,237		
31.09	Dewatering	LS	1		
				Division 31 Subtotal	
Division 33 - Utilities					
33.01	Packaged Pump Installation*	LS	1		$0
33.02	6-inch HDPE Suction Pipe	LF	190		$0
33.03	1 1/2-inch NPT	LF	210		$0
				Division 33 Subtotal	**$0**

* The Packaged Pump Station (skid and enclosure) has been pre-purchased by the County. The concrete pad shall be included in the installation cost.

Submitted by: _____ **Date:** _____

Federal ID#/SS#: _____ **Email:** _____

Address: _____ **Phone:** _____

Authorized Signature: _____ **Fax:** _____

Printed Authorized Signature: _____

Appendix B – Dory Lake Specifications

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

CONTRACT FOR CONSTRUCTION OF A SMALL PROJECT

Prepared By

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

NSPE®
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed By

CSI®
Building Knowledge
Improving Project Delivery

NUCA
We Dig America

CONTRACT FOR CONSTRUCTION OF A SMALL PROJECT

This Contract is by and between **Gilpin County** (Owner) and **[Legal name of Contractor]** (Contractor). Owner and Contractor hereby agree as follows:

ARTICLE 1—THE WORK

1.01 *Work*

A. Work includes all labor, materials, equipment, services, and documentation necessary to construct the Project defined herein. The Work may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

B. The Contractor shall complete all Work as specified or indicated in the Contract Documents. The Project is generally described as follows:

1. **Dory Lake Wet Well Pump Station** which consists of **a new submerged intake to include an air backwash cleaning system and a new wet well with dual submersible pumps**.

2. The Site of the Work includes property, easements, and designated work areas described in greater detail in the Contract Documents but generally located **in Dory Lake and the corridor south of the lake that contains the existing discharge pipe and conduit**.

ARTICLE 2—CONTRACT DOCUMENTS

2.01 *Intent of Contract Documents*

A. It is the intent of the Contract Documents to describe a functionally complete Project. The Contract Documents do not indicate or describe all of the Work required to complete the Project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with Owner and Engineer. This Contract constitutes the entire agreement between Owner and Contractor, and supersedes prior negotiations, representations, and agreements, whether written or oral. The Contract Documents are complementary; what is required by one part of the Contract Documents is as binding as if required by other parts of the Contract Documents.

B. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work under the Contract Documents. During the performance of the Work and until final payment, Contractor and Owner shall submit to Engineer all matters in question concerning the requirements of the Contract Documents, or relating to the acceptability of the Work. Engineer will render a written clarification, interpretation, or decision on the issue submitted, or initiate a modification to the Contract Documents.

C. Contractor, and its subcontractors and suppliers, shall not have or acquire any title to or ownership rights to any of the Drawings, Specifications, or other documents (including copies or electronic media versions) prepared by Engineer or its consultants.

D. *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.

E. Nothing in the Contract Documents creates 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.

2.02 *Contract Documents Defined*

A. The Contract Documents consist of the following documents:

1. This Contract for Construction of a Small Project.
2. Performance bond.
3. Payment bond.
4. Specifications as listed in the Specifications Table of Contents.
5. Drawings as listed on the Drawing Sheet Index.
6. Addenda.
7. Exhibits to this Contract (enumerated as follows):
    a. **[Exhibit 1 – Name of Exhibit]**.
    b. **[Exhibit 2 – Name of Exhibit]**.
8. The following which may be delivered or issued on or after the Effective Date of the Contract:
    a. Notice to Proceed (EJCDC® C-550).
    b. Work Change Directives (EJCDC® C-940).
    c. Change Orders (EJCDC® C-941).
    d. Field Orders (EJCDC® C-942).

ARTICLE 3—ENGINEER

3.01 *Engineer*

A. The Engineer for this Project is **HR Green, Inc**.

ARTICLE 4—CONTRACT TIMES

4.01 *Contract Times*

A. The Work will be substantially complete on or before **[date]** and completed and ready for final payment on or before **[date]**.

B. The Work will be substantially complete within **[number of days]** days after the Effective Date of the Contract and completed and ready for final payment within **[number of days]** days after the Effective Date of the Contract.

4.02 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence in the performance of the Contract, and that Owner will incur damages if Contractor does not complete the Work according to the requirements of Paragraph 4.01. Because such damages would be difficult and costly to determine, Owner and Contractor agree that as liquidated damages for delay in completion (but not as a penalty) Contractor shall pay Owner $**[amount calculated for liquidated damages]** for each day that expires after the Contract Time for substantial completion.

4.03 *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 the Contract Times or Contract Price.

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 or its subcontractors or suppliers.

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.

D. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times 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 or Contractor's subcontractors or suppliers.

4.04 *Progress Schedules*

A. Contractor shall develop a progress schedule and submit it to Engineer for review and comment before starting Work on the Site. Contractor shall modify the schedule in accordance with Engineer's comments.

B. Contractor shall update and submit the progress schedule to Engineer each month. Owner may withhold payment if Contractor fails to submit the schedule.

ARTICLE 5—CONTRACT PRICE

5.01 *Payment*

A. Owner shall pay Contractor, in accordance with the Contract Documents, the lump sum amount of $**[Contract Price]** for all Work.

B. Owner shall pay Contractor, in accordance with the Contract Documents, at the following unit prices for each unit of Work completed:

Item No.	Description	Unit	Estimated Quantity	Unit Price	Extended Price

Total of all extended prices for Estimated Quantities of Work					**$**

Payment will be made in an amount equal to the total of all extended prices for actual Work completed. The extended price is determined by multiplying the unit price times the actual quantity of that Work item completed. Actual quantities installed will be determined by the Engineer.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Bonds*

A. When Contractor delivers the signed counterparts of the Contract to Owner, Contractor shall also deliver the performance bond and payment bond to Owner. Each bond must be in an amount equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds must remain in effect until the completion of the correction period specified in Paragraph 7.12 but, in any case, not less than one year after the date when final payment becomes due.

B. Upon request, Owner will provide a copy of the payment bond to any person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work.

6.02 *Insurance*

A. When Contractor delivers the signed counterparts of the Contract to Owner, Contractor shall furnish certificates, endorsements, and any other evidence of insurance requested by Owner. Insurance is to be provided by companies that are duly licensed or authorized in the jurisdiction in which the Project is located with a minimum A.M. Best rating of A-VII or better. Contractor shall provide insurance in accordance with the following:

1. Contractor shall provide coverage for not less than the following amounts, or greater where required by Laws and Regulations:

a. *Workers' Compensation and Employer's Liability*

Workers' Compensation	Statutory
Employer's Liability	
Each Accident	$
Each Employee	$
Policy Limit	$

b. *Commercial General Liability*

General Aggregate	$
Products - Completed Operations Aggregate	$
Personal and Advertising Injury	$
Bodily Injury and Property Damage—Each Occurrence	$

c. *Automobile Liability*

Bodily Injury	
Each Person	$
Each Accident	$
Property Damage	
Each Accident	$
[OR]	
Combined Single Limit (Bodily Injury and Property Damage)	$

d. *Excess or Umbrella Liability*

Per Occurrence	$
General Aggregate	$

e. *Contractor's Pollution Liability*

Each Occurrence/Claim	$
General Aggregate	$

B. All insurance policies required to be purchased and maintained will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days after notice has been received by the purchasing policyholder. Within three days of receipt of any such notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

C. Automobile liability insurance provided by Contractor will be written on an occurrence basis and provide coverage against claims 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.

D. Contractor's commercial general liability policy will be written on a 1996 or later ISO commercial general liability occurrence form and include the following coverages and endorsements:

1. Products and completed operations coverage maintained for three years after final payment;
2. Blanket contractual liability coverage to the extent permitted by law;
3. Broad form property damage coverage; and
4. Severability of interest; underground, explosion, and collapse coverage; personal injury coverage.

E. The Contractor's commercial general liability and automobile liability, umbrella or excess, and pollution liability policies will include and list Owner and Engineer and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each as additional insureds; and the insurance afforded to these additional insureds will provide primary coverage for all claims covered thereby (including, as applicable, those arising from both ongoing and completed operations) on a non-contributory basis.

1. Additional insured endorsements will 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.

2. Contractor shall provide ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent for design professional additional insureds.

F. Umbrella or excess liability insurance will be written over the underlying employer's liability, commercial general liability, and automobile liability insurance. The coverage afforded must be at least as broad as that of each and every one of the underlying policies. 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.

G. The Contractor shall provide property insurance covering physical loss or damage during construction to structures, materials, fixtures, and equipment, including those materials, fixtures, or equipment in storage or transit.

H. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 15.

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 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. 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 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 notice to and approval by the Owner and Engineer except under extraordinary circumstances.

C. Contractor shall maintain good discipline and order at the Site.

D. Except as otherwise required for the safety or protection of the Work or persons 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.

7.03 *Other Work at the Site*

A. In addition to and apart from the Work of the Contractor, other work may occur at or adjacent to the Site. 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.

B. 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 when Contractor knows that prosecution of the Work may affect them; and Contractor shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for everything necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work must be new and of good quality, and 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 *Subcontractors and Suppliers*

A. Just as Contractor is responsible for its own acts and omissions, 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. 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.

7.06 *Licenses, Fees and Permits*

A. Contractor shall pay all license fees and royalties and assume all costs incident to performing 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.

B. Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy, unless otherwise provided in the Contract Documents.

7.07 *Laws and Regulations; Taxes*

A. Contractor shall give all notices required by, and shall comply with, all local, state, and federal 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 to the fullest extent permitted by law 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 such claims, costs, losses, and damages.

C. Contractor shall pay all applicable sales, consumer, use, and other similar taxes.

7.08 *Record Documents*

A. Contractor shall maintain one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved shop drawings in a safe place at the Site. Contractor shall annotate them to show changes made during construction. Contractor shall deliver these record documents to Engineer upon completion of the Work.

7.09 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work.

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 caused, directly or indirectly, in whole or in part, by Contractor, or anyone for whose acts the Contractor may be liable, will be remedied by Contractor at its expense (except damage or loss attributable to the fault of the Contract Documents or to the acts or omissions of Owner or Engineer and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor).

E. Contractor shall be responsible for coordinating any exchange of 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.

F. In emergencies affecting the safety or protection of the Work or persons or property at the Site or adjacent thereto, Contractor shall act to prevent damage, injury, or loss. Contractor shall give Engineer prompt 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.

7.10 *Submittals*

A. Contractor shall review and coordinate shop drawings, samples, and other submittals with the requirements of the Work and the Contract Documents, and shall verify all related field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information. Contractor shall confirm that the submittal is complete with respect to all related data included in the submittal.

B. Shop drawings and samples must bear a stamp or specific written certification that Contractor has satisfied its obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

C. With each shop drawing or sample submittal, Contractor shall give Engineer specific written notification, in a communication separate from the shop drawing or sample, of any variations that the shop drawing or sample may have from the requirements of the Contract Documents.

D. Engineer will provide timely review of submittals. Engineer's review and approval of submittals will not extend to the means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs.

E. Engineer's review of shop drawings and samples will be only to determine if the items covered 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.

F. Engineer's review and approval of a separate item in a shop drawing or sample does not indicate approval of the assembly in which the item functions.

G. Contractor shall make corrections required by Engineer, return the required number of corrected copies of shop drawings, and submit 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.

H. Shop drawings are not Contract Documents.

7.11 *Warranties and Guarantees*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its consultants are entitled to rely on Contractor's warranty and guarantee.

7.12 *Correction Period*

A. If within one year after the date of substantial completion, any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, or other adjacent areas used by Contractor as permitted by laws and regulations, is found to be defective, then Contractor shall promptly correct any such defective Work and repairs, at no cost to Owner.

7.13 *Indemnification*

A. To the fullest extent permitted by law, 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 all 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.

ARTICLE 8—OWNER'S RESPONSIBILITIES

8.01 *Responsibilities*

A. Except as otherwise provided in the Contract Documents, Owner shall issue all communications to Contractor through Engineer.

B. Owner shall make payments to Contractor as provided in this Contract.

C. Owner shall provide the Site and easements required to construct the Project.

D. 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.

E. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

F. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, unless stated elsewhere in the Contract Documents, Owner shall have sole authority and responsibility for such coordination.

G. 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 for related safety precautions and programs, 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.

ARTICLE 9—ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Engineer's Status*

A. Engineer will be Owner's representative during construction.

B. Neither Engineer's authority or responsibility under this Article 9 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, its subcontractors, suppliers, or sureties, or to any employee or agent of any of them.

C. Engineer will make visits to the Site at intervals appropriate to the various stages of construction. Engineer will not be required to make exhaustive or continuous inspections to check the quality or quantity of the Work.

D. 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 for related safety precautions and programs, 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.

ARTICLE 10—CHANGES IN THE WORK

10.01 *Authority to Change 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.

10.02 *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 the Work which are: (a) ordered by Owner or (b) agreed to by the parties or (c) resulting from the Engineer's decision, 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

3. Changes in the Contract Price or Contract Times or other changes which embody the substance of any final binding results under Article 12.

B. 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.

10.03 *Work Change Directive*

A. A Work Change Directive may be issued to Contractor ordering an addition, deletion, or revision in the Work. A Work Change Directive will not change the Contract Price or Contract Times, but is evidence that the parties expect that the modification ordered or documented by the 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 Contract Price or Contract Times.

10.04 *Field Orders*

A. Engineer may issue a Field Order to authorize minor changes in the Work, provided that the changes do not involve an adjustment in the Contract Price or Contract Times.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then Contractor shall request such adjustment before proceeding with the Work.

ARTICLE 11—DIFFERING SUBSURFACE OR PHYSICAL CONDITIONS

11.01 *Differing Site Conditions Process*

A. If Contractor believes that any subsurface or physical condition (including but not limited to utilities or other underground facilities) that is uncovered or revealed at the Site either (1) differs materially from that shown or indicated in the Contract Documents, or (2) 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 notify Owner and Engineer about such condition. Contractor shall not further disturb such condition or perform any Work in connection with the condition (except with respect to an emergency) until receipt of authorization to do so.

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 Contractor's cost of, or time required for, performance of the Work. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if Contractor knew of, or should have known of, the existence of the condition prior to entry into the Contract.

B. After receipt of notice regarding a possible differing subsurface or physical condition, Engineer will promptly:

1. Review the condition in question;

2. Determine if it is necessary for Owner to obtain additional exploration or tests with respect to the condition;

3. Determine whether the condition falls within one of the two differing site condition categories described in Paragraph 11.01.A.;

4. Obtain any pertinent cost or schedule information from Contractor;

5. Advise Owner of Engineer's findings, conclusions, and recommendations, including recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question, the need for any change in the Drawings or Specifications, and possible Contract Price or Contract Times adjustments.

C. After receipt of Engineer's findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor 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, adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part, and granting any equitable adjustment in Contract Times or Contract Price to which Contractor is entitled.

ARTICLE 12—CLAIMS AND DISPUTE RESOLUTION

12.01 *Claims Process*

A. The party submitting a claim shall deliver it directly to the other party to the Contract and the Engineer promptly (but in no event later than 10 days) after the start of the event giving rise thereto.

B. 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. All actions taken on a claim must be stated in writing and submitted to the other party.

C. If efforts to resolve a claim are not successful, the party receiving the claim may deny it by giving notice of denial to the other party. If the receiving party does not take action on the claim within 45 days, the claim is deemed denied.

D. If the dispute is not resolved to the satisfaction of the parties, Owner or Contractor shall give notice to the other party of the intent to submit the dispute to a court of competent jurisdiction unless the Owner and Contractor both agree to an alternative dispute resolution process.

ARTICLE 13—TESTS AND INSPECTIONS; CORRECTION OF DEFECTIVE WORK

13.01 *Tests and Inspections*

A. Owner and Engineer will have access to the Site and the Work at reasonable times for observation, inspection, and testing. Contractor shall provide proper and safe conditions for such access.

B. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

C. Except as otherwise provided in the Contract Documents, Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required: (1) by the Contract Documents; (2) by codes, laws, or regulations; (3) to attain Owner's and Engineer's acceptance of materials or equipment; and (4) to obtain Engineer's approval prior to purchase of materials, mix designs, or equipment.

D. If any Work 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.

13.02 *Defective Work*

A. Contractor warrants that the Work is not defective.

B. Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. The Contractor shall promptly correct all defective Work.

E. When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's warranty and guarantee on said Work.

F. 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, or any portion thereof, until the cause for such order has been eliminated.

ARTICLE 14—PAYMENTS TO CONTRACTOR

14.01 *Progress Payments*

A. Contractor shall prepare a schedule of values that will serve as the basis for progress payments. The schedule of values will be in a form acceptable to Engineer. Lump sum items will be broken into units that allow for measurement of Work in progress. For unit price work, the unit price breakdown in Article 5 will be used as the schedule of values.

14.02 *Applications for Payments*

A. Contractor shall submit signed applications for payment to Engineer monthly, in a form acceptable to the Engineer. Contractor shall provide supporting documentation required by the Contract Documents. Owner will pay for Work completed as of the date of the application for payment.

B. Beginning with the second application for payment, each application must include an affidavit of Contractor stating that all previous progress payments have been applied to discharge Contractor's obligations associated with the prior applications for payment.

14.03 *Retainage*

A. The Owner shall retain **[percentage of Contract Price to be held as retainage]**% of each progress payment until the Work is substantially complete.

14.04 *Review of Applications*

A. Within 10 days after receipt of each application for payment, Engineer will either recommend payment and present the application for payment to Owner, or return the application for payment to Contractor indicating Engineer's reasons for refusing to recommend payment. The Contractor will make the necessary corrections and may resubmit the application for payment.

B. Engineer will recommend reductions in payment (set-offs) which, in the opinion of the Engineer, are necessary to protect Owner from loss because the Work is defective and requires correction or replacement.

C. The Owner is entitled to impose set-offs against payment based on any claims that have been made against Owner, or any incurred costs, losses, or damages, on account of Contractor's conduct in the performance of the Work; for defective Work; or for liquidated damages that have accrued as a result of Contractor's failure to complete the Work.

14.05 *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.

14.06 *Substantial Completion*

A. When Contractor considers the Work ready for its intended use, Contractor shall request that Engineer issue a certificate of substantial completion. Contractor shall at the same time 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 request, Engineer will inspect the Work with Owner and Contractor to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor and Owner of the reasons for Engineer's decision.

C. If Engineer considers the Work substantially complete, or upon resolution of all reasons for non-issuance of a certificate, Engineer will deliver to Owner and Contractor a certificate of substantial completion that will fix the date of substantial completion and include a punch list of items to be completed or corrected before final payment.

14.07 *Final Inspection*

A. Upon notice from Contractor that the entire Work is complete, Engineer will promptly make a final inspection with Owner and Contractor, and will notify Contractor of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work and remedy such defects.

14.08 *Final Payment*

A. Contractor may make application for final payment after satisfactorily completing all Work, including providing all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents, and other documents.

B. The final application for payment must be accompanied (except as previously delivered) by:

1. All documentation called for in the Contract Documents;

2. Consent of the surety to final payment;

3. 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;

4. A list of all pending claims; and

5. 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.

C. 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.

14.09 *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, 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.

ARTICLE 15—SUSPENSION OF WORK AND TERMINATION

15.01 *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 60 consecutive days by 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 Contract Times, to the extent directly attributable to any such suspension.

15.02 *Owner May Terminate for Cause*

A. Contractor's failure to perform the Work in accordance with the Contract Documents or other failure to comply with a material term of the Contract Documents will constitute a default by Contractor and justify termination for cause.

B. If Contractor defaults in its obligations, then after giving Contractor and any surety 10 days' notice that Owner is considering a declaration that Contractor is in default and the termination of the Contract, Owner may proceed to:

1. Declare Contractor to be in default, and give Contractor and any surety notice that the Contract is terminated; and

2. Enforce the rights available to Owner under any applicable performance bond.

C. Owner may not proceed with termination of the Contract under Paragraph 15.02.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.

D. 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.

E. In the case of a termination for cause, if the cost to complete the Work, including related claims, costs, losses, and damages, exceeds the unpaid contract balance, Contractor shall pay the difference to Owner.

F. If Contractor has provided a performance bond, the provisions of that bond will govern over any inconsistent provisions of Paragraph 15.02.

15.03 *Owner May Terminate for Convenience*

A. Upon 7 days' notice to Contractor, 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 the following, without duplication of any items:

1. Completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, less any set-offs, and 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.

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 60 consecutive days by Owner or under an order of court or other public authority, or (2) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' notice to Owner, and provided Owner does not remedy such suspension or failure within that time, either stop the Work until payment is received, or terminate the Contract and recover payment from the Owner.

ARTICLE 16—CONTRACTOR'S REPRESENTATIONS

16.01 *Contractor Representations*

A. Contractor makes the following representations when entering into this Contract:

1. Contractor has examined and carefully studied the Contract Documents.

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

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

ARTICLE 17—MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of notice to Owner, Engineer, or Contractor, such notice must be in writing, and delivered in person (by

commercial courier or otherwise); by registered or certified mail; or by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

17.02 *Cumulative Remedies*

A. The duties and obligations expressly imposed by this Contract, and the rights and remedies expressly available to the parties under this Contract, are in addition to, and are not to be construed in any way as a limitation of, any duties, obligations, rights, or remedies otherwise imposed or available by laws or regulations, by warranty or guarantee, or by other provisions of the Contract.

17.03 *Limitation of Damages*

A. Neither Owner, 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.

17.04 *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.

17.05 *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.

17.06 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or entering into the Contract.

17.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

The Effective Date of the Contract is **[date to be inserted at the time of execution]**.

Owner:	**Contractor:**
_____ *(typed or printed name of organization)*	_____ *(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 Contractor 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: _____ *Agreement.)*	Email: _____ License No.: _____ *(where applicable)* State: _____

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SECTION 01 0400
GEOTECHNICAL DATA

PART 1 - GENERAL

1.01 EXISTING SUBSURFACE INFORMATION

A. The following subsurface investigation reports at the site of the Work were used during design. These reports shall be considered technical data upon which the Contractor may utili e. All of the information in them may not directly relate to the Work in this project. They are for the Contractor's reference only. Owner or Engineer do not guarantee the information located within these documents. Engineer's Seal does not pertain to any of these reports.

Soil and Foundation Study
Dory Lake Pump Station
Gilpin County, Colorado
A.G. Wassenaar, Inc Project ID: 226085
December 29, 2023

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION 01 0400

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SECTION 01 1000
SUMMARY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Information.
B. Contract Description.
C. Commencement of the Work.
D. Owner Occupancy.
E. Contractor Use of Site and Premises.
F. Layout of the Work.
G. Work Sequence.
H. Permits, Fees and Notices.

1.02 PRO ECT INFORMATION

A. Project Name: Dory Lake Pump Replacement Project
B. Owner's Name: Gilpin County.
   1. Address: 203 Eureka St Central City, Co.
C. Engineer's Name: HR Green, Inc.
   1. Address: 5619 DTC Parkway, Suite 1150 Greenwood Village, CO 80111
   2. Phone: (20 602-4999
D. The Project consists of:
   1. Furnish all labor, materials, and equipment necessary to replace current submersible pump system with an above grade pump skid with hori ontal centrifugal pumps. Project generally consists of abandonment of existing system, installation of intake suction line, pump skid and discharge line connection into the existing system as well as miscellaneous surface restoration.

1.03 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in the Contract.

1.04 QUALITY ASSURANCE

A. Supervision and Superintendent:
   1. The Contractor or competent Superintendent must be on the Project when construction activities are taking place. The Superintendent shall supervise, direct, and control the Contractor's operations, personnel, work and the Subcontractor's operations. The Contractor shall give the Owner and Engineer written notification of the name of the Superintendent. The Superintendent shall be employed by the General Contractor and shall be assigned to the project full-time. The Superintendent shall be incidental to mobili ation. A copy of the Drawings and Specifications shall be available on the project site at all times.
   2. Contractor shall maintain a qualified and responsible person available 24 hours per day, seven days per week to respond to emergencies which may occur after hours. Contractor shall provide to Engineer the phone number and/or paging service of this individual.
   3. Incompetent or incorrigible employees shall be dismissed from Work by Contractor or its representative when requested by Engineer, and such persons shall not again be permitted to return to Work without written consent of Engineer.

1.05 COMMENCEMENT OF THE OR

A. The Contractor shall not commence Work nor allow Subcontractors or Sub-subcontractors to commence Work until:
   1. The Agreement has been fully executed.
   2. The Owner has approved the Contractor's Performance and Maintenance and Payment Bonds.

3. The Owner has approved evidence of the Contractor's Liability Insurance and other insurance required to be purchased by the Contractor.
4. The Engineer, on behalf of the Owner, has issued a Notice to Proceed.

1.06 COMPLETION TIME

A. Work under the proposed Contract Documents shall commence immediately -OR- within 10 days after receipt of the Notice to Proceed and shall be completed and ready for use or operation, subject to any extension of time which may be granted by the Owner, as defined in the agreement.

1.07 O NER OCCUPANCY

A. The Owner shall have the right to take possession of and use any completed or partially completed portions of the Work, notwithstanding the time for completing the entire work or such portions as may not have expired; but such taking, possession and use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents.
   1. If such prior use increases the cost of, or delays the Work, the Contractor shall be entitled to such extra compensation or extension of time, or both, as the Engineer may determine.

B. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
   1. Treatment plant must be maintained in operation throughout the entire construction period, with planned and scheduled shutdowns for connections, cut-ins, changeovers, etc.

C. Cooperate with Owner to minimi e conflict and to facilitate Owner's operations.

D. Schedule the Work to accommodate Owner occupancy and operations.

E. Continuity of treatment system operation.
   1. Conduct work in a manner that avoids interruption of effective treatment system operation.
   2. Prevent the bypass of untreated wastewaters to surface water or drainage ways. Accidental bypasses caused by Contractor’s work activity will entitle Owner to:
      a. Employ others to stop bypassing without giving notice to Contractor.
      b. Recover from the Contractor all costs incurred by the Owner as a result of the bypass, including labor, materials, services, legal fees, regulatory penalties, and other related expenses.
   3. Submit with the Construction Schedule a detailed outage plan and schedule for each system component. Indicate how effective wastewater system operation will be maintained.

1.08 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Limit use of site and premises to allow:
   1. Work by Others.
      a. The Contract has been fully executed.
      b. The Owner has approved the Contractor's Performance and Maintenance and Payment Bonds.
      c. The Owner has approved evidence of the Contractor's Liability Insurance and other insurance required to be purchased by the Contractor.
      d. The Owner has issued a Notice to Proceed.
   2. Work by Owner.
   3. Use of site and premises by the public.

C. All City properties are tobacco free, and policy will be enforced.

D. Provide access to and from site as required by law and by Owner.

E. Emergency Building Exits During Construction: eep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

1.0 LAYOUT OF THE OR

A. The Owner shall provide information to the Contractor regarding bench marks for the project. The Contractor shall be responsible for all detailed construction staking.

1.10 OR SEQUENCE

A. Construct Work in stages to accommodate Owner's occupancy and operational requirements during the construction period. Coordinate construction schedule and operations with Owner.

B. All portions of work under the proposed Contract Documents shall be completed and ready for operation on or before the date set forth in the Notice of Hearing and Letting. Provisions for liquidated damages are set forth in the Contract.

C. The Contractor shall schedule Work so that interruption of existing utilities, including but not limited to: electric, telephone, communication, cable, gas, water, and sewer service will be at a minimum. When it is necessary to interrupt services, the Contractor shall notify the Owner's representative, Engineer, and appropriate utility companies twenty-four (24 hours in advance of the interruption.

D. Plan the construction work and carry out with a minimum of interference with the operation of the existing facilities. Prior to starting the construction, confer with the Engineer and Owner's representative and develop a detailed, approved construction schedule which will permit the facilities to function as normally as practical during the construction period. It will be necessary to do certain parts of the construction work outside normal working hours and on Sundays in order to avoid undesirable conditions, and it shall be the obligation of the Contractor to do this work at such times at no additional cost to the Owner. Do not make connections between existing piping and new piping until necessary inspection and tests have been completed on the new work and it is found to conform in all respects to the requirements of the drawings and specifications.

E. Special notes detailing critical portions of the work involving removal, replacement, tie-in, changeover, etc. have been included in the drawings and the Work Sequence of this Section. These notes describe the work, timing, scheduling, and coordination with the Owner and Engineer necessary to complete the work. The detailed construction schedule shall be developed by the Contractor with consideration of these details and the overall progress of the work. The Engineer and Owner shall have full authority to review this schedule in order to protect the operation of the existing facilities during construction.

1.11 PERMITS, FEES AND NOTICES

A. The Contractor shall secure and pay for all permits and governmental fees, licenses and inspections for the proper execution and completion of the Work which are customarily secured after execution of the Contract and which were legally required at the time bids were received. City building permits and inspections are required, but the permit fees will be exempted.

1.12 SAFETY AND PROTECTION

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. 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, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. 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. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. All damage, injury, or loss to any property 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.

D. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion .

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 1000

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals for Review, Information, and Project Closeout.

B. Number of Copies of Submittals.

C. Submittal Procedures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUBMITTALS FOR REVIE

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit for review according to the procedures and purposes described herein.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. Required Submittal Quality
   1. Organi ation
      a. Cover Labeling
         1 Supplier name, address, and telephone number.
         2 Supplier's designated Project Number.
         3 Engineer's designated Project Name, ob Number, and Location.
         4 Engineer's firm name and location
         5 General contractors name and location
         6 Specification Section(s applicable to submittal contents.
      b. Contents
         1 Cover sheet (same as Exterior Cover requirements with at least a 4" x 4" blank space for Engineers Review Stamp.
         2 Table of Contents for all major equipment/devices/components/descriptions specified.
         3 Notification of all exceptions taken to the specifications.
         4 Order of Contents -- must be the same as order described in the applicable specification sections.
         5 Tabs separating each major equipment division.
   2. Identification of Pertinent Information
      a. Provide Bill of Materials to indicate (at minimum series, model number, and manufacturer.
      b. On catalog cut sheets:
         1 Identify series and complete model number proposed.
         2 Identify information pertinent to proposed model and conformance to specifications by arrow, underline, circular enclosure.
         3 Minimi e non-specific information that does not indicate conformance or cross out non-pertinent information.
      c. On performance data/curves etc. clearly identify pertinent information (or cross out non-pertinent data.
      d. On all documentation provided, illustrate exceptions to the contract documents.
   3. Legible Quality
      a. Font si e no less than 10; minimum character height no less than 1/16".
      b. No faxes accepted.

c. No copies of catalog cuts accepted where information is skewed off page or non-linear.
d. Basic information to be all typewritten; only identification of pertinent information may be hand written.

3.02 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
. Other types indicated.

B. Submit for Engineer's knowledge as contract administrator or for Owner.

3.03 SUBMITTALS FOR PRO ECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 800 - Closeout Submittals:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.04 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native si e and right-side up; illegible files will be rejected.

B. Documents for Information: Submit one copy.

C. Documents for Project Closeout: Make one reproduction of submittal originally reviewed.

3.05 SUBMITTAL PROCEDURES

A. General Requirements:

B. Transmit each submittal electronically with a copy of approved submittal form.

C. Transmit each submittal with Contractor's standard submittal form.

D. Submittal number shall be in reference to Engineer's specification section. If there are multiple submittals to a singular specification section add a hyphen followed by a number. Re-submittals to have original number with an alphabetic suffix.
1. Examples:
a. Two submittals (from same specification section for Project Review: 16 4250-1 16 4250-2; second submittal (after initial review was rejected : 16 4250-2-A.

E. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s , and specification Section number, as appropriate.

F. Apply Contractor's standard certification stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. Submittals without this certification will be returned without review.

G. Deliver submittals to Engineer at business address.

H. Electronic Submittal Procedure
1. Summary:

a. Shop drawing and product data submittals shall be transmitted to Engineer in electronic (PDF format via FTP site or email.

I. Schedule submittals to expedite the Project, and deliver. Coordinate submission of related items.

. Coordinate submittals with other submittals, related activities, sequential activities and overall performance of the Work.

. Revise and submit submittals as required, identify all changes made since previous submittal.

L. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.

M. Clearly identify on the transmittal sheet if the submittal represents “Or Equal” items or substitute items. If the submittal is a substitute, the substitution must result in a decrease in overall cost or result in saving construction time.

N. Contractor to investigate and evaluate for items with long lead times or critical path to execution of the contract, and to coordinate at least these items' submittal groupings with the Engineer. The Engineer accepts no burden for project delays where additional submittal cycles are required to ascertain conformance and intent to the contract documents.

O. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, give written notice thereof at least calendar days prior to release for manufacture.

P. When the shop drawings have been completed to the satisfaction of the Engineer, carry out the construction in accordance therewith and make no further changes therein except upon written instructions from the Engineer.

3.06 ENGINEER S REVIE RESPONSIBILITIES, PROCEDURES AND DEFINITIONS

A. General
1. Review of shop drawings, data, and samples will be for general conformance with the design concept and Contract Documents. They shall not be construed:
a. As permitting any departure from the Contract requirements;
b. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
c. As approving departures from details furnished by the Engineer, except as otherwise provided herein;
d. As approving substitutions to specified products or manufacturers.
2. The Engineer does not review for verification of quantities, weights, dimensions, or means and methods.
3. Partial review status will not be given to a submittal. Entire submittal shall be either acceptable or the entire submittal must be resubmitted with corrections as clarified by status definitions below.
4. Submittals will be reviewed in order received unless Contractor requests a revised order of review, in writing. All submittals shall be submitted sufficiently in advance of construction requirements to provide no less than 15 calendar days for review from the time the Engineer receives them. No less than 30 calendar days will be required for major equipment that requires review by more than one engineering discipline.

B. All submittals that have been reviewed by Engineer will have Engineer's Review Stamp affixed, initialed and dated, indicating Engineer's review action. No submittals shall be used for construction unless they bear the initialed Engineer's Review Stamp. Possible review actions by Engineer are:
1. NO E CEPTIONS NOTED. Engineer's review did not detect deviations from conformance and intent of the Contract Documents.

2. E CEPTIONS NOTED. Engineer's review did not detect major deviations from conformance and intent of the contract documents; minor discrepancies and/or deficiencies are noted. Corrected copies are not required; however, the item(s to be furnished are to be furnished in accordance with the Engineer's comments. If the Contractor elects to take exception to any comments, then corrected copies (with supplemental explanatory data are to be re-submitted to the Engineer similar to a Revise and Resubmit status process.
3. REVISE AND RESUBMIT. Engineer's review found major discrepancies and/or deficiencies, and corrected submittals (in their entirety are required to determine conformance and intent to the contract documents.
4. RE ECTED. Engineer's review concluded that the item(s submitted do not meet the requirements of the "Or Equal" allowance, or a "Substitution" has been provided without proper approval process. An additional submittal cycle is required containing suitable items to determine conformance and intent of the contract documents.
5. REVIEW NOT REQUIRED B CONTRACT DOCUMENTS -- The Engineer's review found that the information submitted is not necessary to evaluate conformance and intent with contract documents.

3.07 RE-SUBMITTALS

A. Re-submittals will be handled in the same manner as first submittals. On re-submittals, direct specific attention, in writing on the transmittal letter and on re-submitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. Make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.

B. Engineer will review all initial information for each submittal. Contractor shall reimburse Owner for the Engineer's charges for review of additional re-submittals. Contractor will be charged for review of all re-submittals over 20 of the initial submittals.
   1. E AMPLE: If the Contractor has a total of 50 initial submittals, there will be no charge for reviewing a combined total of 60 submittals and re-submittals. There will be a charge to review all submittals and re-submittals in excess of 60.

C. The need for more than one re-submittal or any other delay in obtaining Engineer’s review of submittals, will not entitle Contractor to extension of the contract time unless delay of the Work is the direct result of a change in the Work authori ed by a Change Order or failure of Engineer to review and return any submittal to Contractor within the specified review period.

D. An assigned review status of REVISE AND RESUBMIT or RE ECTED requires the original full number of submittals to be resubmitted free of the Engineers previous correction marks and review status stamp. The Engineer reserves the right to retain the same number of copies for each review cycle.

END OF SECTION 01 3000

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Preliminary schedule.

C. Construction progress schedule, bar chart type.

1.02 SUBMITTALS

A. Within 15 days after date of Agreement, submit initial progress schedule in duplicate defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. Revise and resubmit as required.

C. Submit revised schedule with each Application for Payment, identifying changes since previous version.

D. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

E. Indicate estimated percentage of completion for each item of Work at each submission.

F. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates.

1.03 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a hori ontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules to define critical portions of the entire schedule.

E. Include conferences and meetings in schedule.

F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

G. Coordinate content with Schedule of Prices specified in the Proposal.

H. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 REVIE AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Resident Project Representative at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Update diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Engineer, Resident Project Representative, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION 01 3216

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Field Samples.

B. Control of Installation.

C. Testing Services.

D. Control of installation.

E. Tolerances.

F. Manufacturers' Field Services.

1.02 REFERENCES AND STANDARDS - SEE SECTION 01 421

A. Conform to reference standard by date of issue current on date for receiving bids or date of Owner-Contractor Agreement when there are no bids.

1.03 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications Sections for review.

B. Acceptable samples represent a quality level for the Work.

C. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Engineer.

1.04 TESTING SERVICES

A. Contractor shall employ and pay for services of an independent testing agency to perform tests and other testing and inspection specified in individual specification sections and as required by the Engineer.

B. Owner may choose to have Engineer perform certain inspection and testing activities in addition to those specified as required by the Contractor. Payment for initial Owner/Engineer inspection and testing will be by Owner. Payment for Owner/Engineer retesting required because of non-conformance to specified requirements will be charged to the Contractor by deducting inspection and testing charges from the Contract Sum.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and si ed to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
   2. Perform inspections, sampling, testing, and other services specified in individual specification sections and as required by the Engineer.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Engineer and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by Engineer.
   6. Submit reports of all tests/inspections specified to Engineer, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs, equipment, tools, storage, and assistance as requested.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Make arrangements with testing agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Engineer.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

G. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Engineer. Payment for re-testing will be made by the Contractor.

3.04 MANUFACTURERS FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given by Manufacturer's Service Representatives to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report in duplicate within 30 days of observation to Engineer for review.

D. Contractor shall provide qualified Service Representative(s , as necessary to:
   1. Instruct the Contractor's personnel in the installation, startup, and testing of equipment.
   2. Inspect equipment after it is installed to assure that all details of installation are correct and that equipment is prepared for operation in accordance with manufacturer's instructions and recommendations.
   3. Check connections to equipment and adjust, or supervise adjustment of, control and indicating devices after equipment has been installed and connected.
   4. Fully instruct Owner's operating personnel in operation and maintenance of equipment.
   5. Provide Engineer with duplicate copies of final alignment and clearance measurements on all rotating or reciprocating equipment. Measurements shall clearly identify each piece of equipment.
   6. Supervise preliminary operation of equipment and necessary adjustments.

E. Presence of Service Representative will in no way relieve Contractor of any responsibility assumed under Agreement.

F. Work and abilities of Service Representative shall be subject to review of Engineer. If Engineer determines that any Service Representative is not properly qualified, Contractor shall replace Service Representative upon written notification by Engineer.

G. Contractor shall provide continuity in assignment of Service Representative to Work. In event substitution of Service Representative is made which is not at request of Engineer, substitute's time for "familiari ation" shall be at Contractor's expense.

H. Execute manufacturer's certificate of proper installation, found at the end of this section.

MANUFACTURER S CERTIFICATE OF PROPER INSTALLATION

O NER ______________________ **EQPT. SERIAL NO** ______________________

EQPT. TAG NO. ______________________ **EQPT. SYSTEM** ______________________

PRO ECT NO. ______________________ **SPEC. SECTION** ______________________

I HEREBY CERTIFY THAT THE ABOVE-REFERENCED EQUIPMENT SYSTEM HAS BEEN

CHEC APPLICABLE

Installed in accordance with Manufacturer's recommendations.

Inspected, checked, and adjusted.

Serviced with proper initial lubricants.

Electrical and mechanical connections meet quality and safety standards.

All applicable safety equipment has been properly installed.

System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer.

COMMENTS ____
____
____
____
____

I, THE UNDERSIGNED MANUFACTURER S REPRESENTATIVE, HEREBY CERTIFY THAT I AM I A DULY AUTHORI ED REPRESENTATIVE OF THE MANUFACTURER, II EMPO ERED BY THE MANUFACTURER TO INSPECT, APPROVE, AND OPERATE HIS EQUIPMENT AND III AUTHORI ED TO MA E RECOMMENDATIONS REQUIRED TO ASSURE THAT THE EQUIPMENT FURNISHED BY THE MANUFACTURER IS COMPLETE AND OPERATIONAL, EXCEPT AS MAY BE OTHER ISE INDICATED HEREIN. I FURTHER CERTIFY THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND ACCURATE.

DATE ____

MANUFACTURER ____

BY MANUFACTURER S AUTHORI ED REPRESENTATIVE ______________________

(Authori ed Signature

END OF SECTION 01 4000

SECTION 01 4213
ABBREVIATIONS

PART 1 GENERAL

1.01 GENERAL

A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various international, national, regional, or local organi ations, such organi ations may be referred to by their acronym or abbreviation only. As a guide to the user of these Specifications, the following acronyms or abbreviations which may appear in these Specifications shall have the meanings indicated herein.

1.02 ABBREVIATION

A. AAMA - Architectural Aluminum Manufacturer's Association
B. AASHTO - American Association of State Highway and Transportation Officials
C. AATCC - American Association of Textile Chemists and Colorists
D. ACI - American Concrete Institute
E. AFBMA - Anti-Friction Bearing Manufacturer's Association, Inc.
F. AGA - American Gas Association
G. AGMA - American Gear Manufacturer's Association
H. AI - The Asphalt Institute
I. AIA - American Institute of Architects
. AISC - American Institute of Steel Construction
. AISI - American Iron and Steel Institute
L. AMCA - Air Moving and Conditioning Association
M. ANS - American Nuclear Society
N. ANSI - American National Standards Institute, Inc.
O. APA - American Plywood Association
P. API - American Petroleum Institute
Q. APWA - American Public Works Association
R. ASA - Acoustical Society of America
S. ASAE - American Society of Agricultural Engineers
T. ASCE - American Society of Civil Engineers
U. ASHRAE - American Society of Heating, Refrigerating, and Air Conditioning Engineers
V. ASME - American Society of Mechanical Engineers
W. ASQC - American Society for Quality Control
. ASSE - American Society of Sanitary Engineers
. ASTM - American Society for Testing and Materials
. AWPA - American Wood Preservers Association
AA. AWPI - American Wood Preservers Institute
BB. AWS - American Welding Society
CC. AWWA - American Water Works Association
DD. BBC - Basic Building Code, Building Officials and Code Administrators International
EE. BHMA - Builders Hardware Manufacturer's Association
FF. CBM - Certified Ballast Manufacturers

GG. CEMA - Conveyors Equipment Manufacturer's Association
HH. CGA - Compressed Gas Association
II. CMA - Concrete Masonry Association
. CRSI - Concrete Reinforcing Steel Institute
. EIA - Electronic Industries Association
LL. ETL - Electrical Test Laboratories
MM. EPA - Environmental Protection Agency
NN. FM - Factory Mutual System
OO. FPL - Forest Products Laboratory
PP. HI - Hydronics Institute
QQ. IAPMO - International Association of Plumbing and Mechanical Officials
RR. ICBO - International Conference of Building Officials
SS. IEEE - Institute of Electrical and Electronics Engineers
TT. IES - Illuminating Engineering Society
UU. IME - Institute of Makers of Explosives
VV. IP - Institute of Petroleum (London
WW. IPC - Institute of Printed Circuits
. ISA - Instrument Society of America
. ISO - International Organi ation for Standardi ation
. ITE - Institute of Traffic Engineers
AAA. MBMA - Metal Building Manufacturer's Association
BBB. MPTA - Mechanical Power Transmission Association
CCC. MSS - Manufacturing Standardi ation Society
DDD. NAAMM - National Association of Architectural Metal Manufacturer's
EEE. NACE - National Association of Corrosion Engineers
FFF. NBS - National Bureau of Standards
GGG. NEC - National Electrical Code
HHH. NEMA - National Electrical Manufacturer's Association
III. NFPA - National Fire Protection Association
. NFPA - National Forest Products Association
. NLGI - National Lubricating Grease Institute
LLL. NMA - National Microfilm Association
MMM. NSF - National Sanitation Foundation
NNN. NWMA - National Woodwork Manufacturers Association
OOO. OSHA - Occupational Safety and Health Administration
PPP. PCA - Portland Cement Association
QQQ. PPI - Plastics Pipe Institute
RRR. RCRA - Resource Conservation and Recovery Act
SSS. RVIA - Recreational Vehicle Industry Association
TTT. RWMA - Resistance Welder Manufacturer's Association
UUU. SAE - Society of Automotive Engineers

VVV. SAMA - Scientific Apparatus Makers Association
WWW. SMA - Screen Manufacturers Association
. SMACCNA - Sheet Metal and Air Conditioning Contractors National Association
. SPI - Society of the Plastics Industry, Inc.
. SPIB - Southern Pine Inspection Bureau
AAAA. SPR - Simplified Practice Recommendation
BBBB. SSBC - Southern Standard Building Code, Southern Building Code Congress
CCCC. SSPC - Steel Structures Painting Council
DDDD. SSPWC - Standard Specifications for Public Works Construction
EEEE. UBC - Uniform Building Code
FFFF. UL - Underwriters Laboratories, Inc.
GGGG. WCLIB - West Coast Lumber Inspection Bureau
HHHH. WCRSI - Western Concrete Reinforcing Steel Institute
IIII. WEF - Water Environment Federation
. WIC - Woodwork Institute of California
. WRI - Wire Reinforcement Institute, Inc.
LLLL. WWPA - Western Wood Products Association

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 4213

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SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities.

B. Temporary telecommunications services.

C. Temporary Water Service.

D. Temporary Sanitary Facilities.

E. Water Control.

F. Protection of Installed Work.

G. Temporary Controls: Barriers, enclosures, and fencing.

H. Security Requirements.

I. Vehicular Access and Parking.

. Waste Removal.

. Field Offices.

1.02 TEMPORARY UTILITIES

A. Contractor shall provide and pay for all electrical power required for construction purposes.

1.03 TEMPORARY HEAT

A. Contractor shall provide and pay for heat devices and heat as required to maintain specified conditions for construction operations.

1.04 TEMPORARY TELEPHONE SERVICE

A. Telecommunications services shall include:

B. Provide, maintain, and pay for mobile phone service for the field superintendent or other Contractor field representative.

C. A cellular phone shall be acceptable as temporary phone service. Provide phone number to Engineer and Owner.

1.05 TEMPORARY ATER SERVICE

A. Make suitable arrangements for temporary water service if water is needed for construction or testing. There will be no cost to the Contractor for water used.

1.06 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures for Contractor's workers, Engineer's personnel, Owner's personnel and testing firm personnel working at project site. Provide at time of project mobili ation.

B. Portable toilets shall be acceptable. Comply with all applicable codes and regulations. Arrange for regular cleaning and/or replacement of portable toilets.

C. Maintain daily in clean and sanitary condition.

1.07 ATER CONTROL

A. Conform to the regulations and requirements of legally authori ed surface water management agencies.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. eep trenches and other areas free from water as required to permit continuous progress of work, to prevent damage to Contractor’s work, and to work of others. Refer to Section 31 2319 for dewatering.

D. Conduct operations in such a manner to prevent sediment from reaching existing sewers and storm drains.

E. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

F. Cover exposed excavated areas and spoil piles when runoff from rain is likely to cause turbidity to enter local waterways. Suspend work in the rain if such work cannot be performed without causing turbid runoff.

G. Prevent solids or turbid runoff from entering local waterways. Cover, secure and /or berm excavated area and spoil piles.

H. Where necessary, divert stream through closed pipe system to minimi e downstream erosion, sedimentation, and turbidity during construction.

1.08 PROTECTION OF INSTALLED OR

A. Protect installed Work and provide special protection where specified in individual specification Sections.

1.0 BARRIERS

A. Provide barriers to prevent unauthori ed entry to construction areas, to prevent access to areas that could be ha ardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.10 FENCING

A. Construction: Contractor's option.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.11 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthori ed entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.12 VEHICULAR ACCESS AND PAR ING

A. Maintain existing roads.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.

D. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow.

E. Provide and maintain access to fire hydrants, free of obstructions.

F. Provide means of removing mud from vehicle wheels before entering streets.

G. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.13 ASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

1.14 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 10 persons.

C. Provide separate private office similarly equipped and furnished, for use of Engineer and Owner.

D. Locate offices a minimum distance of 30 feet from existing and new structures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 5000

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SECTION 01 5713
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Performance bond.

E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.

B. Section 31 1000 - SITE CLEARING: Limits on clearing; disposition of vegetative clearing debris.

1.03 REFERENCE STANDARDS

A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a enon Arc-Type Apparatus.

B. ASTM D4533/D4533M - Standard Test Method for Trape oid Tearing Strength of Geotextiles.

C. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

D. ASTM D4 51 - Standard Test Methods for Determining Apparent Opening Si e of a Geotextile.

E. ASTM D48 3/D48 3M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

F. EPA (NPDES - National Pollutant Discharge Elimination System (NPDES , Construction General Permit.

G. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control.

H. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service.

1.04 PERFORMANCE REQUIREMENTS

A. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

B. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

C. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.

D. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

E. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

F. Erosion On Site: Minimi e wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

H. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
   2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

I. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

. Open Water: Prevent standing water that could become stagnant.

. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Erosion and Sedimentation Control Plan:
   1. Include:
      a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
      b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
      c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
      d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
      e. Other information required by law.
      f. Format required by law is acceptable, provided any additional information specified is also included.
   2. Obtain the approval of the Plan by authorities having jurisdiction.
   3. Obtain the approval of the Plan by Owner.

C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authori ed official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mulch: Use one of the following:
   1. Straw or hay.
   2. Wood waste, chips, or bark.
   3. Erosion control matting or netting.
   4. Cutback asphalt.
   5. Polyethylene film, where specifically indicated only.

B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

C. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
   1. Average Opening Si e: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4 51.
   2. Ultraviolet Resistance: Retaining at least 0 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
   3. Tensile Strength: 100 pounds-force, minimum, in cross-machine direction; 124 pounds-force, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
   4. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
   5. Tear Strength: 55 pounds-force, minimum, when tested in accordance with ASTM D4533/D4533M.
   6. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

D. Silt Fence Posts: One of the following, minimum 5 feet long:

E. Concrete: See Section 03 3000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.
   1. Width: As required; 20 feet, minimum.
   2. Length: 50 feet, minimum.
   3. Provide at each construction entrance from public right-of-way.
   4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fences.
   1. Provide linear sediment barriers:
      a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
   2. Space sediment barriers with the following maximum slope length upslope from barrier:
      a. Slope of Less Than 2 Percent: 100 feet..
      b. Slope Between 2 and 5 Percent: 5 feet.
      c. Slope Between 5 and 10 Percent: 50 feet.
      d. Slope Between 10 and 20 Percent: 25 feet.
      e. Slope Over 20 Percent: 15 feet.

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:

1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
2. Straw bale row blocking entire inlet face area; anchor into pavement.

E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.

F. Temporary Splash Pads: Stone aggregate over filter fabric; si e to suit application; provide at downspout outlets and storm water outlets.

G. Soil Stockpiles: Protect using one of the following measures:
1. Cover with polyethylene film, secured by placing soil on outer edges.
2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.
2. Asphalt: Use only where no traffic, either vehicular or pedestrian, is anticipated.

I. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

A. Traffic-Bearing Aggregate Surface:
1. Excavate minimum of 6 inches.
2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
3. Place and compact at least 6 inches of 1 1/2 to 3 1/2 inch diameter stone.

B. Silt Fences:
1. Store and handle fabric in accordance with ASTM D48 3/D48 3M.
2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
5. Install with top of fabric at nominal height and embedment as specified.
6. Do not splice fabric width; minimi e splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.

C. Temporary Seeding:
1. When hydraulic seeder is used, seedbed preparation is not required.
2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
3. If temporary mulching was used on planting area but not removed, apply nitrogen fertili er at 1 pound per 1000 sq ft.
4. On soils of very low fertility, apply 10-10-10 fertili er at rate of 12 to 16 pounds per 1000 sq ft.
5. Incorporate fertili er into soil before seeding.
6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.
. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
8. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:
   1. Promptly replace fabric that deteriorates unless need for fence has passed.
   2. Remove silt deposits that exceed one-third of the height of the fence.
   3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Clean out temporary sediment control structures weekly and relocate soil on site.

E. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Engineer.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01 5713

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SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Warranty.

C. Re-use of Existing Products.

D. Product Option Requirements.

E. Substitution Limitations and Procedures.

F. Procedures for Owner-Supplied Products.

G. Transportation, Handling, Storage and Protection.

H. Spare Parts and Maintenance Materials.

1.02 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
   1. After review, distribute in accordance with Article on Procedure above and for Record Documents described in Section 01 800.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
   2. Include identification on each sample, with full Project information.
   3. Submit two samples as specified in individual specification Sections; one of which will be retained by Engineer.
   4. Reviewed samples which may be used in the Work are indicated in individual specification Sections.

1.03 ARRANTY

A. All Products as defined below shall be provided with manufacturer's full warranty against defects in materials and workmanship for two years after Date of Substantial Completion, including all parts, labor, and expenses, unless otherwise required in individual specification Sections.
   1. This manufacturer's warranty shall be in addition to the Contractor's guarantee secured by the Performance and Maintenance Bond.

B. Substantial Completion. In addition to the definition provided in the General Conditions, the following applies: Sufficient completion of the project or the portion thereof to permit utili ation of the project, or portion thereof for its intended purpose. Substantial completion requires not only that the work be sufficiently completed to permit utili ation, but that the Owner can effectively utili e the substantially completed Work. Determination of substantial completion is solely at the discretion of the Owner. Substantial completion does not mean complete in accordance with the Contract nor shall substantial completion of all or any part of the project entitle the Contractor to acceptance under the Contract.

C. Final Completion. When the Engineer deems the Project and Punch List fully complete in accordance with Plans and Specification, and when all items including but not limiting to: excess building materials, concrete forms, construction trailers, field offices, and temporary traffic control have been removed from site, the Engineer shall notify the Owner in writing and recommend final acceptance of work. Sales and Use Tax Forms and Lien Waivers do not have to be completed but are encouraged to be completed as a condition of Final Completion. The date of final completion shall be the date the Engineer's written recommendation of final acceptance to the Owner.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NE PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:

C. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions.
   2. If wet-applied, have lower VOC content.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. A request for substitution constitutes a representation that the submitter:
   1. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

3.02 O NER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.

3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimi e site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimi e handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimi e waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
   1. Contractor shall be paid for materials and equipment stored off-site, upon proper documentation of delivery, control and protection of said materials and equipment. Contractor's insurance shall be in full force at this off-site location for complete protection of said materials and equipment.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 6000

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SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.
B. Coordination
C. Examination, Preparation, and General Installation Procedures.
D. Requirements for alterations work, including selective demolition.
E. Cutting and Patching.
F. Alterations.
G. Laying Out the Work.
H. Progress Cleaning.
I. Starting Systems.
. Demonstration and Instruction.
. Closeout Procedures.

1.02 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather-exposed or moisture-resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

1.03 PRO ECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
B. Dust Control: Execute work by methods to minimi e raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Minimi e dust nuisance by cleaning, sweeping, vacuum sweeping, sprinkling with water, or other means. The use of water in amounts that result in mud on public streets or roads is not an acceptable substitute for sweeping. Equipment for this operation shall be available at all times.
C. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimi e amount of bare soil exposed at one time.
   2. Provide temporary measures such as silt fences, filter fabric, sedimentation ponds, placement berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
D. Noise Control: Provide methods, means, and facilities to minimi e noise produced by construction operations.
   1. Restrict construction involving noisy operations, including starting and warming up of equipment, to the hours between :00 a.m. and 8:00 p.m. on weekdays. The exception to this requirement includes the need to operate equipment for temporary wastewater pumping.

2. Each internal combustion engine, used for any purpose on the job or related to the job, shall be enclosed and be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without muffler and enclosure.

E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

F. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

1.04 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utili e spaces efficiently to maximi e accessibility for other installations, for maintenance, and for repairs.

E. Coordinate completion and clean-up of work of separate sections.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

PART 3 EXECUTION

3.01 LAYING OUT THE OR

A. Verify locations of survey control points prior to starting work.

B. Contractor shall locate and protect survey control and reference points.

C. Control datum for survey is that established by Owner provided survey.

D. Utili e recogni ed engineering survey practices.

E. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and hori ontal lines, unless otherwise indicated.

C. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

D. Materials: As specified in product Section; match existing products and work for patching and extending work.

E. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

F. Remove, cut, and patch work in a manner to minimi e damage and to provide a means of restoring products and finishes to original condition.

G. Make neat transitions between different surfaces, maintaining texture and appearance.

3.03 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Engineer before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications : Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimi e duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

D. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

E. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

F. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer.

G. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Engineer review and request instructions.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

. Finish surfaces as specified in individual product Sections.

. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
1. Patch as specified for patching new work.

L. Clean existing systems and equipment.

M. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

N. Do not begin new construction in alterations areas before demolition is complete.

O. Comply with all other applicable requirements of this section.

3.04 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute cutting, fitting, and patching, including excavation and fill, to complete Work, and to:
1. Fit the several parts together, to integrate with other Work.
2. Uncover Work to install or correct ill-timed Work.
3. Remove and replace defective and non-conforming Work.
4. Remove samples of installed Work for testing.
5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

E. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

L. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

M. Identify any ha ardous substance or condition exposed during the Work to the Engineer for decision or remedy.

3.05 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

C. After painting begins or permanent heating system is started, use vacuum cleaning in lieu of broom cleaning methods.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and properly dispose off-site; do not burn or bury.

3.06 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer and Owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authori ed representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01 4000 that equipment or system has been properly installed and is functioning correctly.

I. Perform subsequent testing, adjusting, and balancing of equipment and systems as required to provide operation according to the manufacturer's recommendations and the Contract Documents.

3.07 DEMONSTRATION AND INSTRUCTION

A. See Section 01 900 - Demonstration and Training.

B. Demonstrate operation and maintenance of products to Owner's personnel prior to date of Substantial Completion.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at designated location.

D. Utili e operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.08 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Engineer.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Engineer when work is considered ready for Final Completion.

D. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.

E. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

F. Submit Contractor's Statement listing all State where project is located sales/use taxes, waivers of liens from all Subcontractors and suppliers, and other items required by the Contract Documents.

G. Conduct Substantial Completion inspection and create Final Correction Punch List containing Engineer's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Engineer.

END OF SECTION 01 7000

SECTION 01 7413
CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning during progress and at the completion of the Work as required by General Conditions.

1.02 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

1.03 RESPONSIBILITIES AND COORDINATION BET EEN PRIME CONTRACTORS

A. Contractor is responsible for cleaning their own installed materials and equipment, both during and at the completion of construction. Each Contractor is responsible for removing and disposing waste, rubbish, and debris off the site in an approved landfill area.

B. If Contractor fails to clean exposed surfaces and/or remove debris from site, the Owner may clean up and charge the cost to the Contractor responsible as the Owner determines to be just.

C. Contractor is responsible for final cleaning of floors, walks, and grounds.

PART 2 PRODUCTS

2.01 MATERIALS

A. Contractor to provide all equipment required to complete cleaning.

B. Use only those cleaning materials which will not create ha ards to health or property and which will not damage surfaces.

C. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

D. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

A. Execute periodic cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.

B. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

C. After painting begins or permanent heating system is started, use vacuum cleaning in lieu of broom cleaning methods.

3.02 FINAL CLEANING

A. In addition to the requirements for clean-up as specified in the General Conditions, the Contractor shall remove to the Owner's satisfaction, all asphalt or concrete spilled on or around the buildings. Dispose of all rubbish and debris from the site in an approved landfill area.

B. Employ skilled workmen for final cleaning.

C. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.

D. Wash and shine gla ing and mirrors.

E. Polish glossy surfaces to a clear shine.

F. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

G. Prior to final completion, or Owner occupancy, the Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces, and all work areas to verify that the entire work is clean.

END OF SECTION 01 7413

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SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Instruction of Owner's Personnel.

D. Warranties and Bonds.

1.02 SUBMITTALS

A. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.
   2. Submit two (2 copies of preliminary draft hard copies (paper or proposed formats and outlines of contents before start of Work. Submit one (1 copy of preliminary electronic format before start of work. Engineer will review draft and return one copy with comments.
   3. Submit three copies of approved data in final form prior to final inspection or acceptance.
   4. Submit five (5 electronic and paper copies of approved data in final form prior to final inspection or acceptance.

B. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRO ECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Contract Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.

B. Store record documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish main floor datum.
   2. Measured hori ontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

E. Submit documents to Engineer prior to claim for final Application for Payment.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data for particular installation. Organi e in consistent format under separate headings for different procedures. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

E. Copy of each warranty, Bond, and service contract issued. Provide information sheet for Owner's personnel, giving proper procedures in event of failure and instances which might affect validity of warranties or Bonds.

3.03 INSTRUCTION OF O NER S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Manual for equipment and systems shall constitute basis of instruction. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

C. Any presentation or training materials shall be provided to the Owner in format presented (i.e. Microsoft format, Office 365 or less .

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance. Include predicted life of parts subject to wear and list of items recommended to be stocked as spare parts.

I. Provide control diagrams by controls manufacturer as installed.

. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

L. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

M. Content for each electrical and electronic system, as appropriate.
   1. Description of system and component parts:
      a. Function, normal operating characteristics, and limiting conditions.
      b. Performance curves, engineering data, and tests.
      c. Complete nomenclature and commercial number of replacement parts.
   2. Circuit directories of panel boards:
      a. Electrical service.
      b. Controls.
      c. Communications.
   3. As-installed color coded wiring diagrams.
   4. Operating procedures:
      a. Routine and normal operating instructions.
      b. Sequences required.
      c. Special operating instructions.
   5. Maintenance procedures:
      a. Routine operations.
      b. Guide to "trouble-shooting".
      c. Disassembly, repair, and assembly.
      d. Adjustment and checking.
   6. Manufacturer's printed operating and maintenance instructions.
   . List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

N. Prepare and include additional data when need for such data becomes apparent during instruction of Owner's personnel.

O. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS HARD COPIES - PAPER

A. Prepare instructions and data by personnel:
   1. Trained and experienced in maintenance and operation of described products.
   2. Familiar with requirements of this section.
   3. Skilled as technical writers to extent required to communicate essential data.
   4. Skilled as draftsmen competent to prepare required drawings.

B. Prepare data in the form of an instructional manual for use by Owner's personnel.

C. Format: 8-1/2 x 11 inch paper with 20 lb. minimum, white, for typed pages.

D. Binders: Commercial quality, 8-1/2 by 11 inch binders with durable and cleanable plastic covers; 3 inch maximum ring si e. When multiple binders are used, correlate data into related consistent groupings.
   1. Label spine of binder with identity of general subject matter covered in manual.

E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify: title of Project, identity of separate structure as applicable, and identity of general subject matter covered in manual.

F. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to si e of text pages.

H. Contents: Neatly typewritten table of contents for each volume, arranged in systematic order with consecutive page numbers.
   1. Contractor, name of responsible principal, address, and telephone number.

2. List of each product required to be included, indexed to content of volume.
3. List, with each product, name, address, and telephone number of:
   a. Subcontractor or installer.
   b. Maintenance contractor, as appropriate.
   c. Identify area of responsibility of each.
   d. Local source of supply for parts and replacement and list of recommended spare parts.
4. Identify each product by product name and other identifying symbols as set forth in Contract documents, including nameplate information and shop order numbers for each item of equipment furnished.
5. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
6. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

I. Provide 30 days prior to actual start-up.

3.06 OPERATION AND MAINTENANCE MANUALS ELECTRONIC

A. Prepare instructions and data by personnel:
   1. Trained and experienced in maintenance and operation of described products.
   2. Familiar with requirements of this section.
   3. Skilled as technical writers to extent required to communicate essential data.
   4. Skilled as draftsmen competent to prepare required drawings.

B. Prepare data in the form of an instructional manual for use by Owner's personnel.

C. Format: Electronic copy shall be delivered on a unique CD-ROM in Adobe Acrobat's Portable Document Format (PDF and Microsoft Word versions. The PDF file(s shall be fully indexed using the table of contents, searchable with thumbnails generated. The Microsoft Word files shall be easily found using unique file naming conventions with reference list.

D. Cover: Identify each CD-ROM with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify: title of Project, identity of separate structure as applicable, and identity of general subject matter covered in manual.
   1. Contents: Neatly typewritten table of contents for each volume, arranged in systematic order.
   2. List of each product required to be included, indexed to content of volume.
   3. List, with each product, name, address, and telephone number of:
      a. Subcontractor or installer.
      b. Maintenance contractor, as appropriate.
      c. Identify area of responsibility of each.
      d. Local source of supply for parts and replacement and list of recommended spare parts.
   4. Identify each product by product name and other identifying symbols as set forth in Contract Documents, including nameplate information and shop order numbers for each item of equipment furnished.

3.07 ARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Completion is determined.

B. Verify that documents are in proper form, contain full information, and are notari ed.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

END OF SECTION 01 7800

SECTION 01 7 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.

1.02 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organi ation of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O M manuals.

I. Product- and System-Specific Training:
   1. Review the applicable O M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasi e safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   . Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.

9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 01 7 00

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SECTION 03 1000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

E. Design of Forms, Shores and Reshores ct Contractor.
   1. For certain tall pours, design of forms, shores and reshores by Contractor-employed specialty engineer, or use of pre-engineered forms.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 31 2316 - Excavation: Shoring and underpinning for excavation.

1.03 REFERENCE STANDARDS

A. ACI 11 - Specifications for Tolerances for Concrete Construction and Materials.

B. ACI 301 - Specifications for Structural Concrete.

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

D. ACI 34 R - Guide to Formwork for Concrete.

E. ACI 350/350R - Code Requirements for Environmental Engineering Concrete Structures and Commentary;.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric .

H. COE CRD-C 5 2 - Corps of Engineers Specifications for Polyvinylchloride Waterstop.

1.04 DEFINITIONS

A. "Formwork Specialty Engineer" ("FSE" : Professional Engineer employed by Contractor to be in responsible charge of the design of formwork, falsework, shoring, reshoring, etc. FSE shall be a registered Professional Engineer currently licensed in good standing in Colorado.

1.05 DESIGN REQUIREMENTS

A. Design and engineering of formwork shall be the responsibility of the Contractor.

B. For wet concrete vertical lifts of over 10 feet, or for falsework below slabs where slab is over 10 ft above ground, formwork/falsework shall be either:
   1. A pre-engineered standard design from a formwork specialty vendor, or
   2. Custom-designed and PE-certified by FSE.

C. Design and erect formwork in accordance with the requirements of ACI 318 and ACI 350 and as recommended in ACI 34 R.

1.06 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Submit name and Professional Engineer license number of FSE, and letter of acknowledgement that FSE is in responsible charge of design for items specified.

C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1. Proposed method of sealing form tie holes.
2. Form release agent
3. The review, approval, or both of the formwork drawings does not relieve the Contractor of the responsibility for adequately constructing and maintaining the forms so that they will function properly.

1.07 QUALITY ASSURANCE

A. Perform work of this section in accordance ACI 11 , ACI 301, ACI 318, and ACI 34 .
   1. Maintain one copy of each listed standard on project site. Make documents available to workers and inspectors at all times.

B. Formwork, falsework, and shoring designs shall be prepared by FSE.

C. FSE shall be responsible for providing Contractor with maximum allowable rate of fill for forms, in light of actual concrete mix designs. Contractor shall furnish FSE with concrete mix design information, and shall keep FSE apprised of any changes to mix designs.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.01 FORM OR - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Chamfer outside corners of beams, joists, columns, and walls.

D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

E. Comply with relevant portions of ACI 301, ACI 318, ACI 34 R, ACI 301, ACI 318, ACI 34 R, ACI 301, ACI 318, and ACI 34 R.

2.02 FORM MATERIAL

A. Rigid and substantial forms shall be constructed in all cases to produce required dimensions and finish of the concrete, and to support the wet concrete adequately.

B. Whenever flowing liquids are to come in contact with concrete surfaces and the concrete is to be exposed above grade, smooth metal or approved manufacturer's forms shall be used.

2.03 REMOVABLE PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gauge, 0.0598 inch thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Preformed Aluminum Forms: ASTM B221 (ASTM B221M , 6061-T6 alloy, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Preformed Plastic Forms: Thermoplastic polystyrene form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

D. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

E. Pan Type: Steel, of si e and profile indicated.

F. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches thick.

2.04 FORM OR ACCESSORIES

A. Form Ties: Snap-off type, galvani ed metal, fixed length, cone type, with waterproofing washer, 1.5 inch inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

C. All forms shall be equipped with adequate devices for spreading and tying formwork and for supporting the steel reinforcing.

D. Through-bolt ties shall not leave holes in concrete larger than 1.25" diameter. Ties shall be commercially manufactured. Wire and band iron will not be accepted.

E. Form Release Agent: Colorless mineral oil that will not stain concrete.
   1. Product must not impair the bond of paint, sealant, epoxy coating, dampproofing or other coatings.

F. Wood strip chamfers shall be 3/4" x 3/4" using maximum possible lengths. Surface in contact with concrete shall be planed smooth.

G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Si ed as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Earth forms are not permitted without prior written approval from the Engineer.

3.03 ERECTION - FORM OR

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301 I and recommendations of ACI 34 R.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Align joints and make watertight. eep form joints to a minimum.

D. Obtain approval before framing or blocking openings in structural members that are not indicated on drawings.

E. Provide chamfer strips on external corners of beams, joists, and columns exposed to view and 1 foot below finished grade, and on all exterior corners of water-containing channels..
   1. Chamfer strips are required whether specifically indicated on Drawings or not.

F. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

G. Coordinate this section with other sections of work that require attachment of components to formwork.

H. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Engineer before proceeding.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. eep surfaces coated prior to placement of concrete.

D. Do not allow form release agent to puddle in forms or come into contact with existing concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, thimbles, embedded plates, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

3.06 FORM PREPARATION CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter. The method of snow and ice removal shall not involve extreme heat or impact and shall not damage the existing concrete.

3.07 FORM OR TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 11 , unless otherwise indicated.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than three (3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.0 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

1. Formwork not supporting weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 48 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained as specified in Section 03 3000.
2. As a minimum, concrete forms shall remain in place for a period as determined byACI 34 R.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION 03 1000

SECTION 03 2000
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Deformed reinforcing steel for concrete masonry (CMU construction.

C. Supports and accessories for steel reinforcement.

D. Adhesive rebar anchors

E. Mechanical connectors

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.

B. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI 11 - Specifications for Tolerances for Concrete Construction and Materials.

B. ACI 301 - Specifications for Structural Concrete.

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

D. ACI 350/350R - Code Requirements for Environmental Engineering Concrete Structures and Commentary;

E. ACI SP-66 - ACI Detailing Manual.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

G. ASTM A 06/A 06M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

H. ASTM A 5/A 5M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.

I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel.

L. CRSI (DA4 - Manual of Standard Practice.

M. CRSI (P1 - Placing Reinforcing Bars.

N. ICC Evaluation Service, Inc. (ICC : Evaluation Reports.

1.04 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices. Shop drawings must also comply with additional specific requirements below:

1. Placing drawings (applies to reinforced concrete and reinforced masonry shall have sufficient detail to permit installation of reinforcing without reference to the Contract Documents.
2. Do not reproduce Contract Documents, but redraw plans, sections, elevations and details as necessary to show all bars and supports.
3. Show required clear cover on all section views for each face of concrete or masonry.
   a. Reinforcing drawings that do not show clear cover will be rejected without review.
4. Bar supports: call out type and si e of applicable bar support(s on each reinforcing drawing.

C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis, if requested by Engineer.

E. Product Data:
   1. Mechanical connectors and adhesive rebar anchors:
      a. Current ICC evaluation report or equivalent code agency report listing findings to include installation instructions, acceptance, special inspection requirements and restrictions.
      b. Manufacturer's published installation instructions.
      c. Test data for each si e of bar to be used.
         1 Mechanical Connectors: Verification that connector is capable of developing 125 percent of bar yield strength.
         2 Adhesive Rebar Anchors: Embedment depth required to develop ultimate bond strength equal to or greater than 125 percent of bar yield strength in 3,000 psi concrete. Embedment depth may be based on interpolation but not extrapolation of published test data.
            (a In lieu of submitting test data above, embed all adhesive rebar anchors a minimum of twelve (12 times the bar diameter for 6 bars and smaller, and sixteen (16 times the bar diameter for bars and larger.

F. Conduits or pipes passing through columns , beams or joists: Submit all such proposed cases, indicating material to be used for pipe or conduit and indicating all proposed dimensional information, additional reinforcing, clear distances, etc.

G. Mechanical splices not shown on Drawings: Submit all proposed locations.

H. Adhesive rebar anchors not shown on Drawings: Submit all proposed locations.

1.05 QUALITY ASSURANCE

A. Certify that reinforcing steel meets applicable specifications.

B. Perform work of this section in accordance with ACI 301 and CRSI "PRB" and "MSP".
   1. Maintain one copy of each document on project site. Make documents available to workers and inspectors at all times.

C. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcing to site free of rust and in an undamaged condition. Store in a manner to protect from rusting and contact with injurious materials.
   1. Store all bars on blocking above the ground.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Deformed Billet-Steel Reinforcing Bars; including stirrups, ties, and spirals: Grade 60 (420 .
   1. Uncoated - to be used for all reinforcing unless noted otherwise:ASTM A615, Grade 60,
   2. Epoxy coated (where indicated : ASTM A 5/A 5M, Grade 60.

B. Steel Welded Wire Reinforcement (WWR : Galvani ed, deformed type; ASTM A1064/A1064M.
   1. Form: Flat Sheets.
   2. Mesh Si e and Wire Gage: As indicated on drawings.

2.02 RE-BAR SPLICING

A. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing full steel reinforcing design strength in tension and compression.

B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.

C. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

2.03 CONNECTORS

A. Mechanical Connections:
   1. Mechanical Threaded Connections: Metal coupling sleeve for splicing reinforcing with internal threads engaging threaded ends of bars developing in tension or compression 125 percent of yield strength of bar.

B. Adhesive Rebar Anchors:
   1. "Capsule" system or "no le-mixed" system as specified herein:
      a. Capsule System": Polyester or vinyl ester resin and hardener premeasured and separately encased in a manufactured capsule. Manufacturer's standard aggregate may also be included in capsule.
      b. "No le-Mixed" System: Two-component structural epoxy in premanufactured double cartridge (or co-axial cartridge . Mixing of components shall occur within the cartridge or in the manufacturer's specially fabricated mixing no le. Manufacturer's standard aggregate may also be included in cartridge.
   2. Adhesive shall be specifically designed and manufactured for use in structurally bonding reinforcing bars to hardened concrete
   3. Bars shall be embedded to a depth sufficient to develop an ultimate bond strength equal to 125 percent of the yield strength of the bar, assuming embedment in 3,000 psi concrete.
   4. Manufacturer:
      a. If no embedment/load information is submitted per 1.03.D.1.c.2, then manufacturer/product must be one of the following:
         1 Hilti RE500SD.
         2 ITW Red Head Epcon C6
         3 No substitutions.
      b. If embedment/load information is submitted per 1.03.D.1.c.2, then manufacturer may be one of the following:
         1 Hilti.
         2 ITW Red Head.
         3 Simpson.
         4 Powers.

2.04 ACCESSORIES

A. Tie Wire: Annealed, minimum 16 gage (1.5 mm .
   1. Use coated wire (nylon, plastic or epoxy for epoxy-coated bars.

B. Chairs, Bolsters, Bar Supports, Spacers: Si ed and shaped for adequate support of reinforcement during concrete placement.
   1. Precast concrete bar supports, cementitious fiber-reinforced bar supports, or all-plastic bar supports and side form spacers consistent with CRSI Manual of Standard Practice.
   2. In Beams, Walls, and Slabs Exposed to View After Stripping: Small rectangular concrete blocks made up of same color and strength as concrete being placed around them or all-plastic bar supports and side form spacers.
   3. Precast concrete supports of same strength as concrete for reinforcing in concrete placed on grade.
   4. For slabs on grade, use concrete bricks
   5. For chairs, bolsters, bar supports, and spacers sitting on grade, load bearing pads on bottom are required to prevent vapor barrier puncture, where applicable.
   6. Plastic-tipped metal chairs are not acceptable for any surface which will be exposed to weathering, soil, or water/wastewater, or will be immediately above exposed water/wastewater.

2.05 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (MSP - Manual of Standard Practice, ACI SP-66 - ACI Detailing Manual, and ACI 318

B. Welding of reinforcement is permitted only where shown, or with the specific written approval of Engineer. Perform welding in accordance with AWS D1.4.

C. Bend cold to conform with required details; bend bars in fabricating shop before delivery to site.

D. Bar fabrication tolerances: ACI 11 .

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement using preformed wire bar bolsters and spacers. Do not deviate from required position.
   1. For walls with two mats of reinforcing, both mats must be chaired the proper clear distance from the face of form, and mats must be separated by intermediate -shaped bars to keep the mats separated by the proper distance. No tie wire shall be permitted to extend from rebar mat to face of form.

B. Place concrete only after reinforcing system is in place and approved by Engineer; install reinforcing system plumb and true; tie securely; reinforcing must remain in proper position without distortion or displacement of individual bars or system during pour.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing as indicated on Drawings.

E. All joints or splices shall be made by using approved mechanical connectors or by lapping the ends of the bars according to ACI 318. oints in longitudinal bars shall be staggered where indicated. Splicing top bars over supports and bottom bars at center span shall be avoided. Lap splices for all reinforcing bars are shown on the Drawings.

F. Splicing shall be consistent with ACI 318 and ACI 350.

G. Field bending of reinforcing bars will not be permitted.

H. Where parallel hori ontal reinforcement in beams is indicated to be placed in two or more layers, rebars in the upper layer shall be placed directly above rebars in the bottom layer with clear distance between the layers to be 1 inch (unless noted otherwise . Place spacer rebars at 3 FT maximum centers to maintain the required clear distance between layers.

I. Maximum si e of single conduit or pipes shall be limited in placement as follows:
   1. None above top reinforcing layer or below bottom reinforcing layer.
   2. None closer than 3 conduit diameters to each other or one conduit diameter to nearest reinforcing.
   3. None through columns, beams or joists without review of Engineer.

. Location Tolerances: In accordance with CRSI publication, "Placing Reinforcing Bars".
   1. Contractor must have one copy of publication on-site and available to workers and inspectors at all times.

. Mechanical Splices and Connections:
   1. Use only in areas specifically indicated or approved in writing by the Engineer.
      a. Submit proposed connection locations (other than those shown on Drawings per Paragraph 1.03.F
   2. Install as required by manufacturer and in accordance with ICC Report.
      a. If manufacturer's instructions differ from installation instructions of ICC Report, the more stringent requirements shall govern.
   3. Maintain minimum edge distance and concrete cover.
   4. Inspect each mechanical splice/connector as required by ICC Report.

L. Tying Deformed Reinforcing Bars:
   1. Tie every other intersection on mats made up of Nos. 3, 4, 5, and 6 bars.
   2. For larger bars, tie every intersection.
   3. Bend all noncoated tie wire to prevent tie wire from being closer than 1 inch from the surface of concrete.

M. Reinforcement Around Openings: Place an equivalent area of steel bars around pipe or opening as shown and extend reinforcement on each side sufficiently to develop bond with each bar (per detail on Drawings .

N. Do not weld or tack weld any reinforcement other than ASTM A 06 bars specifically indicated to be welded.

O. Cleaning: Clean metal reinforcement of loose mill scale, oil, earth, concrete splatter (laitance , and other contaminants.

P. Comply with applicable code for concrete cover over reinforcement.

3.02 ADHESIVE REBAR ANCHORS

A. Install anchors using only materials, equipment and procedures recommended by manufacturer and in accordance with ICC Report. Follow all installation and curing instructions exactly.
   1. If manufacturer's instructions differ from installation instructions of ICC Report, the more stringent requirements shall govern.

B. Use anchors only at locations specifically indicated on Contract Drawings or approved by Engineer.
   1. Submit proposed anchor locations (other than those shown on Drawings per Paragraph 1.03.G.

C. Install in holes drilled with carbide tipped drill bits. Do not cut reinforcing steel.

D. All adhesive anchors must be inspected twice - once at conclusion of hole drilling/cleaning, and once during adhesive/bar insertion.

3.03 FIELD QUALITY CONTROL

A. Inspect all reinforcement for compliance with Contract Documents. If deficiencies are not corrected, or if an interpretation of the Contract Documents is required, notify the Engineer immediately.

B. Notify Engineer when reinforcing is fully placed, tied and ready for inspection and allow 24 hours for Engineer's inspection prior to placing concrete.

C. Adhesive rebar anchors:
   1. Notify Engineer when adhesive rebar anchors are ready for each of two separate inspections. Allow 24 hours for Engineer's inspection.
   2. Any adhesive rebar anchor completed without inspection is subject to rejection by Engineer, and subject to replacement by an additional adhesive rebar anchor at no additional expense to Owner.

END OF SECTION 03 2000

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SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floors and slabs on grade.
B. Concrete walls
C. Anchors and Inserts.
D. oint devices associated with concrete work.
E. Testing concrete
F. Concrete curing.

1.02 REFERENCE STANDARDS

A. ACI 11 - Specifications for Tolerances for Concrete Construction and Materials.
B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
C. ACI 301 - Specifications for Structural Concrete.
D. ACI 302.1R - Guide to Concrete Floor and Slab Construction.
E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
F. ACI 305R - Guide to Hot Weather Concreting.
G. ACI 306R - Guide to Cold Weather Concreting.
H. ACI 308R - Guide to External Curing of Concrete.
I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
. ACI 34 R - Guide to Formwork for Concrete.
. ACI PRC-309-05 - Guide for Consolidation of Concrete.
L. ACI 350R - Code Requirements for Environmental Engineering Concrete Structures and Commentary,
M. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
N. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
O. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
P. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
Q. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
R. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
S. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm Cube Specimens .
T. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
U. ASTM C150/C150M - Standard Specification for Portland Cement.
V. ASTM C1 1 - Standard Specification for Sheet Materials for Curing Concrete.
W. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Po olan for Use in Concrete.

. ASTM C845/C845M - Standard Specification for Expansive Hydraulic Cement.

AA. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

BB. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

CC. ASTM C110 /C110 M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink .

DD. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete.

EE. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

FF. ASTM D994/D994M - Standard Specification for Preformed Expansion oint Filler for Concrete (Bituminous Type .

GG. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

HH. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.

II. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

. ASTM E1155M - Standard Test Method for Determining F(F Floor Flatness and F(L Floor Levelness Numbers (Metric .

. ASTM E1 45 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

LL. COE CRD-C 5 2 - Corps of Engineers Specifications for Polyvinylchloride Waterstop.

1.03 DEFINITIONS

A. Defective Areas: Surface defects that include honeycomb, rock pockets, cracks 0.005 inch wide and larger, cracks that leak in water-holding basins, spalls, chips, embedded debris, sand lines, bleed lines, leakage from form joints, fins and other projections, and form popouts.

B. Qualified Mix Designer:
   1. Colorado registered professional engineer experienced in concrete mix design or
   2. Independent Testing Agency experienced in concrete mix design.

C. New Concrete: Less than 60 days old.

1.04 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittal procedures.

B. Shop Drawing:
   1. Product Data:
   2. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
      a. Admixtures.
      b. Bonding agent.
      c. Patching materials.
      d. Portland Cement.
      e. Non-shrink Grout
   3. Mix Design: Submit proposed concrete mix design.
   4. Design Data: Concrete mix designs signed by qualified mix designer.
   5. Placement Drawings: Concrete placement, identifying location of each type of construction joint.
   6. Gradation for coarse and fine aggregates, and combined together. List gradings, percent passing through each sieve si e.
   . Curing methods proposed.

8. Detailed plan for cold weather curing and protection of concrete placed and cured in weather below 40 degrees F.
9. Detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F.
10. Detailed plan for repair and patching of defective concrete areas.

C. Concrete Mixes: Submit 30 days (minimum prior to first scheduled concrete use.
1. Summary Letter, certified by Mix Designer
   a. Mix design summary letter from Mix Designer, including all of the following information for each concrete mix in the Project in tabular form:
      1 Concrete Mix Designation that will appear on Delivery Ticket.
      2 Name and location of ready mix plant(s supplying this mix.
      3 Design F'c, slump and air content for this mix.
      4 Standard deviation of ready mix plant(s used in calculation of F'cr for this mix, if applicable.
      5 Indicate whether mix design is based on “trial batches” or “field experience”.
      6 F'cr for this mix.
2. Mix Designs
   a. For each Mix Designation identified in summary letter, submit:
      1 Mix design following ACI flow chart procedure.
      2 Weight and volume of all mix ingredients, including brand and type, if applicable.
      3 Water/cementitious ratio clearly identified.
      4 Coarse aggregate si e designation, corresponding to a gradation submitted under paragraph above.
      5 Slump.
      6 Air content.
      Compressive strength test results used to generate standard deviation for mix, if applicable.
      8 F'cr for mix.
      9 Compressive strength test results verifying that mix meets F'cr:
         (a Trial batch test results or
         (b Test results for similar mix “field experience".

D. Quality Control:
1. Manufacturer's application instructions for bonding agent.
2. Proposed application schedule and instructions for patching materials.
3. Manufacturers' Certificate of Compliance:
   a. Portland cement.
   b. Admixtures.
   c. Bonding agent.
   d. Patching materials.
4. Admixtures: Manufacturers' Certificate of Proper Usage and certification that all admixtures are compatible with each other and the aggregates.
5. Statements of Qualification:
   a. Mix designer.
   b. Batch plant.
6. Test Reports:
   a. Admixtures, test reports showing chemical ingredients and percentage of chloride in each admixture and fly ash and cement.
   b. Statement identifying aggregates reactivity and aggregate effects on concrete finish and appearance.

. Concrete Delivery Tickets. Submit certified copy of ticket for each load of concrete delivered to site. Hand to Owner's representative immediately upon arriving at job site. Include on ticket:
   a. Name and location of batch plant and name of plant representative.

b. Ticket number.
c. Load number (batch number .
d. Date and truck number.
e. Destination of concrete in the Work (identified by elevation, grid, etc. .
f. Concrete type and class (strength and Mix Designation.
g. Amount of concrete in cubic yards.
h. Time at which mixer drum was charged with cement.
i. Type, brand, and amount of cement.
j. Type, brand, and amount of each admixture added at plant.
k. Type, brand, and amount of fiber reinforcement.
l. Source and amount of each metered or weighed water added at plant.
m. Information necessary to calculate the total mixing water. Total mixing water includes free water on aggregates, batch water (metered or weighed including ice batched at the plant, and wash water retained in the mixing drum.
   1 Aggregate moisture must be measured not less than once per day.
n. Maximum si e of aggregate.
o. Mass (amount of fine and coarse aggregate.
p. Actual water/cementitious ratio of load as it left batch plant.
q. Signature or initials of plant representative.
r. Amount of any materials added to drum after truck left batch plant; time at which additional materials were added; and reading of revolution counter.
s. Time of arrival of truck on site.
t. Time at which concrete unloading began, and reading of revolution counter.
u. Time at which concrete unloading was completed.
v. If job-site testing is done on any concrete from load, identify test number for cross-referencing.
w. If superplastici er is added at site, record slump before and after addition of superplastici er. Record time and/or drum revolutions as necessary to show that mixing complied with superplastici er manufacturer's recommendations

E. Test Reports: Submit report for each test or series of tests specified.

F. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

G. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301, ACI 318, and ACI 11 .
   1. Maintain one copy of each document on site.

B. Acquire cement from same source and aggregate from same source for entire project.

C. Follow recommendations of ACI 305R when concreting during hot weather.

D. Follow recommendations of ACI 306R when concreting during cold weather.

E. Batch Plant:
   1. Currently certified by the National Ready Mixed Concrete Association, or approved (in writing to supply concrete to the Colorado Department of Transportation. Submit copy of certification
   2. Batch Plant Inspection:
      a. Engineer shall have access to and have the right to inspect batch plants, cement mills, and supply facilities of Suppliers, manufacturers, and Subcontractors, providing products included in these Specifications.
      b. Weighing Scales: Tested and certified within tolerances set forth in the National Bureau of Standards Handbook No. 44.
      c. Batch Plant Equipment: Either semiautomatic or fully automatic in accordance with ASTM C94.

F. Preinstallation Meetings:
   1. Required Meeting Attendees:
      a. Contractor.
      b. Ready-mix producer.
      c. Admixture representative.
      d. Engineer.
      e. Testing Agency.
   2. Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.
   3. Agenda shall include:
      a. Admixture types, dosage, performance, and redosing at site.
      b. Mix designs, test of mixes, and Submittals.
      c. Placement methods, techniques, equipment, consolidation, and form pressures.
      d. Slump and placement time to maintain slump.
      e. Finish, curing, and water retention.
      f. Discussion of formwork design requirements.
      g. Other specified requirements requiring coordination.
   4. Provide meeting minutes as specified in Division 1.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Blended Cement: ASTM C595, Type 1L

B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.
   2. Natural Aggregates:
      a. Free from deleterious coatings and substances in accordance with ASTM C33, except as modified herein.
      b. Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
   3. Nonpotentially Reactive: In accordance with ASTM C33, Appendix I, paragraph 1.1.
   4. Aggregate Soundness: Test for fine and coarse aggregates in accordance with ASTM C33 and ASTM C88 using sodium sulfate solution.
   5. Fine Aggregates:
      a. Clean, sharp, natural sand.
      b. Materials Passing 200 Sieve: 3 percent maximum.
      c. Limit deleterious substances in accordance with ASTM C33, Table 1 with material finer than 200 sieve limited to 3 percent, coal and lignite limited to 0.5 percent.
   6. Coarse Aggregate:
      a. Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension .
      b. Well-graded, per industry-standard definition (no gap-graded aggregates allowed .
      c. Materials Passing 200 Sieve: 0.5 percent maximum.
      d. Limit deleterious substances in accordance with ASTM C33, Table 3 for exposed architectural concrete.

C. Po olan (Fly Ash : Not Permitted

D. Water: ASTM C1602/C1602M .

E. Synthetic fibers: fibrillated nylon or polypropylene.
   1. ASTM C1116/C1116M, Type III.
   2. Dosage: Minimum 1.5 LB/cubic yard.
   3. Manufacturers:
      a. Propex - Fibermesh 300.

b. Grace - Grace Fibers.
c. Euclid Chemical Co. - Fiberstrand F.
d. GRT - Polymesh.

2.02 ADMIXTURES

A. Characteristics: Compatible with each other and free of chlorides or other corrosive chemicals.

B. All admixtures shall be supplied from the same manufacturer and used in accordance with the manufacturer's recommendations.

C. Air Entrainment Admixture: ASTM C260/C260M.

D. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.

F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

G. Accelerating Admixture: ASTM C494/C494M Type C.

H. Retarding Admixture: ASTM C494/C494M Type B.

I. Water Reducing Admixture: ASTM C494/C494M Type A.

. Shrinkage Reducing Admixture:
1. ASTM C494/C494M, Type S.

. Shrinkage Compensating Admixture: For on site production of concrete with ASTM C845/C845M, Type cement.

L. Shrinkage Compensating Admixture with Fiber Reinforcement: For on site production of concrete with ASTM C845/C845M, Type cement with integral fiber reinforcement.

M. Waterproofing Admixture: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties.

N. Waterproofing Admixture System: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties; includes manufacturer-provided field services and performance warranty.

O. Air Entrainment Admixture: ASTM C 260; contain no chlorides.

P. Water-Reducing Admixtures: ASTM C 494, Type A - Water Reducing and Type D - Water Reducing and Retarding.
1. Manufacturers:
a. BASF.
b. Grace.
c. Euclid Chemical Co.
d. GRT.

Q. Superplastici ers:
1. ASTM C494.
2. Hold slump of 5 inches or greater for time required for placement into structure with maximum water-cement ratio specified.
3. Furnish type as recommended by manufacturer for allowed temperature ranges.
4. Type F.
5. Manufacturers:
a. BASF.
b. Grace.
c. Euclid Chemical Co.
d. GRT.

2.03 ACCESSORY MATERIALS

A. Reglets: Formed stainless steel sheet, grade 304 or better, with temporary filler to prevent concrete intrusion during placement.

B. Bonding Agent: ASTM C 1059, Type II acrylic non-redispersable type.

1. Furnish as recommended by manufacturer for surface finish, pot life, set time, vertical or hori ontal application, and forming restrictions.
   a. Manufacturers:
      1 BASF.
      2 W.R. Meadows.
      3 L M Construction Chemicals.
      4 Sika Chemical Corp.
      5 Euclid Chemical Co.

C. Patching Mortar:
   1. Contains no chlorides or other chemicals causing steel corrosion.
   2. Pre-manufactured product, cement-based, suitable for vertical and overhead applications.
   3. Compressive strength at 28 days: 6500 psi minimum
   4. Manufacturers:
      a. BASF.
      b. L M Construction Chemicals.
      c. Sika Chemical Corp.
      d. Euclid Chemical Co.

D. Expansion oint Filler: Neoprene, closed-cell, expanded, in accordance with ASTM D1056, Type 2C5 with compression deflection, 25 percent deflection (limits , 1 to 24 psi minimum.

E. Chemical Hardener: Magnesium Flurosilicate solution designed for densification of cured concrete slabs. Hardener shall be compatible with other specified floor treatments and curing compounds. Apply to all slabs unless noted otherwise.

F. Non-Shrink Grout:
   1. ASTM C 110 .
   2. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   3. Minimum Compressive Strength at 28 Days: ,000 pounds per square inch.
   4. Manufacturers:
      a. L M Construction Chemicals, Inc., Crystex.
      b. Euclid Chemical Co., Hi Flow Grout.

2.04 BONDING PRODUCTS

A. Bonding Agent: ASTM C 1059, Type II acrylic non-redispersable type.
   1. Furnish as recommended by manufacturer for surface finish, pot life, set time, vertical or hori ontal application, and forming restrictions.
   2. Use for all indicated "bonding agent" applications unless specifically directed otherwise on Drawings or by Engineer.
   3. Manufacturers:
      a. BASF.
      b. W.R. Meadows
      c. L M Construction Chemicals.
      d. Sika Chemical Corp.
      e. Euclid Chemical Co.

B. Epoxy Bonding System: ASTM C 881, type as required by project conditions.

C. Slab Isolation oint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

2.05 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
   1. Manufacturers:
      a. Dayton Superior Corporation: www.daytonsuperior.com/ sle.
      b. Euclid Chemical Company ; EUCOBAR: www.euclidchemical.com/ sle.

c. aufman Products Inc; VaporAid: www.kaufmanproducts.net/ sle.
d. Nox-Crete Inc; Monofilm: www.nox-crete.com/ sle.
e. W. R. Meadows, Inc ; Evapre or Evapre-RTU: www.wrmeadows.com/ sle.

B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
1. Product dissipates within 4 to 6 weeks.
2. Manufacturers:
a. Dayton Superior Corporation; : www.daytonsuperior.com/ sle.
b. aufman Products Inc; Thinfilm 420 Resin Base: www.kaufmanproducts.net/ sle.
c. Nox-Crete Inc; Res-Cure DH 100: www.nox-crete.com/ sle.
d. SpecChem, LLC; SpecRe : www.specchemllc.com/ sle.
e. W. R. Meadows, Inc; 1100-Clear: www.wrmeadows.com/ sle.
f. Substitutions: See Section 01 6000 - Product Requirements.

C. Curing Agent, Water-Cure Equivalent Type: Clear, water-based, non-film-forming, liquid-water cure replacement agent.
1. Compressive Strength of Treated Concrete: Equal to or greater than strength after 28-day water cure when tested according to ASTM C39/C39M.

D. Membrane Curing Compound: ASTM C309 Type 1 - Clear or translucent, Class A.
1. Acrylic type.
2. Provide ure-N-Seal manufactured by Sonneborn or Engineer approved equivalent.
3. Curing compound must be NSF approved for use in potable water systems.

E. Moisture-Retaining Sheet: ASTM C1 1.
1. Curing paper, regular.
2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
3. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

F. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.

G. Water: Potable, not detrimental to concrete.

2.06 CONCRETE MIX DESIGNS

A. Design:
1. Select and proportion ingredients using trial batches or field test data. Sample, cure, and test concrete mix through an approved independent testing laboratory in accordance with ACI 211.1
2. ACI 301, 318, and 350 each contain a flow chart for selecting proportions of concrete mixtures, and submitting the proposed mixes for approval. Contractor, concrete mix supplier and Mix Designer must all be familiar with basic requirements of flow chart and include the following basic elements in the design and submittal of all concrete mixes:
a. Determine whether sufficient test data exists to calculate appropriate standard deviations(s for each ready mix plant that will supply concrete for the Work.
b. Calculate required average strength, F'cr, for each concrete mix. F'cr: Equal to F'c plus 1,200 when data is not available to establish standard deviation.
c. Show that proposed mixes meet or exceed F'cr by:
1 Determining whether sufficient test data exists to prove adequacy of proposed mix by virtue of similarity to previously-produced concrete, or
2 Preparing and testing trial batches.
3. Concrete Compressive Strength, F'c:
a. See schedule on Drawings
1 Use additional cement or cement plus fly ash above minimum specified if required to meet average compressive strength, F'cr.

2 For concrete mixes developed by laboratory testing, base cementitious content of the concrete on a curve showing the relation between water cementitious ratio and and 28 day compressive strengths of concrete made using the proposed materials. Determine curves by four or more points, each representing an average value of at least three test specimens at each age. Provide curves with a range of values sufficient to yield the desired data, including the compressive strengths specified, without extrapolation. The cementitious content of the concrete mixes to be used, as determined from the curve, shall correspond to strengths 1200 psi greater than the specified design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content specified.

4. Proportions
   a. Design mix to meet aesthetic and structural concrete requirements.
   b. In accordance with ACI 211.1, unless specified otherwise.
   c. Water-cementitious (W/C ratio shall control amount of total water added to concrete per schedule on Drawings
5. Admixtures:
   a. Air Content: Per schedule on Drawings.
   b. Fly Ash: Per schedule on Drawings..
6. Slump Range at Site (Maintain Until Consolidated in Form :
   a. After adding superplastici ers: 5 to 8 inches.
   b. Before adding superplastici ers: 1 to 3 inches.

2.07 MIXING

A. General: In accordance with ACI 304R.

B. Truck Mixers:
   1. Equip with electrically actuated counters to readily verify number of revolutions of drum or blades.
   2. Counter:
      a. Resettable, recording type, mounted in driver's cab.
      b. Actuated at time of starting mixers at mixing speeds.
   3. Truck mixer operation shall furnish a concrete batch as discharged, that is homogeneous with respect to consistency, mix, and grading.
   4. Do not use nonagitating or combination truck and trailer equipment for transporting ready-mixed concrete.
   5. Concrete Volume in Truck:
      a. Limit to 63 percent of total volume capacity, in accordance with ASTM C94, when truck mixed.
      b. Limit to 80 percent of total volume capacity when central mixed.
   6. Mix each batch of concrete in truck mixer for minimum 0 revolutions of drum or blades at rate of rotation designated by equipment manufacturer.
   . Perform additional mixing, if required, at speed designated by equipment manufacturer as agitating speed.
   8. Place materials, including mixing water, in mixer drum before actuating the revolution counter for determining number of mixing revolutions.

C. Aggregates: Thoroughly and uniformly wash before use.

D. Admixtures:
   1. Air-Entraining Admixture: Add at plant through manufacturer-approved dispensing equipment.
   2. Water Reducers: Add prior to addition of superplastici er.
   3. Superplastici ers and Air-Entraining Admixtures:
      a. Add at concrete plant or at project site only through equipment furnished or approved by admixture manufacturer.

b. Equipment shall provide for easy and quick visual verification of admixture amount used for each dose.
c. Add discharge amount to each load of concrete into separate dispensing container, verify amount is correct, then add to concrete.
d. Additional dosage of superplastici er may be added in the field using manufacturer-approved dispensing when unexpected delays cause too great of a slump loss.

E. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

B. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

3.02 PLACING CONCRETE

A. Preparation: Meet requirements and recommendations of ACI 304R and ACI 301, except as modified herein.

B. Notify Engineer not less than 24 hours prior to commencement of placement operations.

C. Hand batch ticket for each load of concrete to ENGINEER at time of truck arrival on site.

D. No additional water may be added to the concrete at any time after the truck has left the batch plant.

E. Discharge Time:
1. As determined by set time, do not exceed 1 1/2 hours after adding cement to water unless special approved time delay admixtures are used. Coordinate information with admixture manufacturer and Engineer prior to placing concrete.
2. Adjust slump or air content at site by adding admixtures for particular load when approved by Engineer, then adjust plant dose rest of placement. Additional dosage at site shall be through an approved dispenser supplied by admixture manufacturer.
3. Maintain required slump throughout time of concrete placement and consolidation. Discontinue use of superplastici er if it fails to maintain slump in required range for the length of time required. Redesign mix, adjusting set control admixtures to maintain setting time in the range required.

F. Placement into Formwork:
1. Before depositing concrete, remove debris from space to be occupied by concrete.
2. Prior to placement of concrete, dampen fill under slabs on ground, dampen sand where vapor retarder is specified, and dampen wood forms.
3. Reinforcement: Secure in position before placing concrete.
4. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 1.5 feet deep, except for slabs. Place and consolidate successive layers prior to initial set of first layer to prevent cold joints.
5. Use placement devices, for example, chutes, pouring spouts, and pumps.
6. Vertical Free Fall Drop to Final Placement: Maximum 4 feet in forms.
. Do not use aluminum conveying devices.
8. Provide sufficient illumination for interior of forms so concrete at places of deposit are visible permitting confirmation of consolidation quality.
9. oints in Slabs:
a. Ensure space beneath plastic water stop completely fills with concrete.
b. During concrete placement, make visual inspection of entire water stop area.
c. Limit concrete placement to elevation of water stop in first pass, vibrate concrete under water stop, lift water stop to confirm full consolidation without voids, place remaining concrete to full height of slab.

d. Apply procedure to full length of water stops.

10. If reinforcement is in direct sunlight or is more than 20 degrees F higher in temperature than concrete temperature before placement, wet reinforcement with water fog spray before placing concrete to cool reinforcement.
11. Round off top exposed edges of walls with a 1/2 inch radius steel edging tool. Control joint edges round off exposed edge to 1/4-inch radius.
12. Do not place concrete for supported elements until concrete previously placed in the supporting element has attained design strength.

G. Conveyor Belts and Chutes:
1. Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system for concrete to pass without becoming segregated.
2. Do not use chutes longer than 50 feet.
3. Minimum Slopes of Chutes: Angled to allow concrete to readily flow without segregation.
4. Conveyor Belts:
a. Approved by Engineer.
b. Wipe clean with device which does not allow mortar to adhere to belt.
c. Cover conveyor belts and chutes.

H. Retempering: Not permitted for concrete where cement has partially hydrated.

I. Pumping of Concrete:
1. Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to assure completion of concrete placement without cold joints in case of a primary placing equipment breakdown.
2. Minimum Pump Hose (Conduit Diameter: 4 inches.
3. Replace pumping equipment and hoses (conduits that are not functioning properly.

. Maximum Si e of Concrete Placements:
1. Limit si e of each placement to allow for strength gain and volume change due to shrinkage.
2. Where expansion joints or construction or control joints are not shown, or are spaced at more than 60 feet, provide intermediate construction joints at maximum spacing of 40 feet.
3. Consider beams, girders, brackets, column capitals, and haunches as part of floor or roof system and place monolithically with floor or roof system.
4. Should placement sequence result in cold joint located below finished water surface, install water stop in joint.

. Minimum Time Between Adjacent Placements:
1. Construction oints: 3 days.
2. At least 2 hours shall elapse after depositing concrete in long columns and walls thicker than 8 inches before depositing concrete in beams, girders, or slabs supported thereon.
3. For columns and walls, 10 feet in height or less, wait at least 45 minutes prior to depositing concrete in beams, girders, brackets, column capitals, or slabs supported thereon.

L. Consolidation and Visual Observation:
1. Consolidate concrete with internal vibrators with minimum frequency of 8,000 cycles per minute and amplitude required to consolidate concrete in section being placed.
2. Provide at least one standby vibrator in operable condition at placement site prior to placing concrete.
3. Consolidation Equipment and Methods: ACI PRC-309-05.
4. Provide sufficient windows in forms, or limit form height, to allow for concrete placement through windows and for visual observation of concrete.
5. Vibration consolidation shall not exceed a distance of 5 feet from point of placement.
6. Vibrate concrete in vicinity of joints to obtain impervious concrete.

M. Hot Weather:
1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 305R.

2. Placement frequency shall be such that lift lines will not be visible in exposed concrete finishes.
3. Maintain concrete temperature below 80 degrees F at time of placement. Ingredients may be cooled before mixing.
4. Temperature of forms and reinforcement shall not exceed 90 degrees when concrete is placed.
5. Make provisions for windbreaks, shading, fog spraying, sprinkling, ice, or wet cover, or other means to provide concrete with temperature specified.
6. Prevent differential temperature between reinforcing steel and concrete.

N. Cold Weather:
1. Maintain surface temperature of concrete above 40 degrees F and cure concrete.
2. Provide maximum and minimum thermometers placed on concrete surfaces spaced throughout Work to allow monitoring of concrete surface temperatures representative of Work.
3. Contractor to furnish temperature records daily to Engineer. eep for each pour for seven days. Record temperature at two hour intervals for:
   a. Outside air.
   b. Concrete as placed.
   c. Air in coldest part of enclosure near concrete.
   d. Locations as directed by Engineer.
4. In accordance with ACI 306R and ACI 318.
5. Heated Enclosures:
   a. Heated enclosures may be used at any time during "cold weather" as defined by ACI 306.
   b. Heated enclosures must be used when outdoor temperature falls below 5 degrees F.
   c. Enclosures must be capable of supporting wind and snow loads and tight enough to prevent entrance of wind and weather.
6. External Heating Units:
   a. Vent heating units to atmosphere, and do not locally heat or dry concrete. Where water cure is specified, maintain wet condition.
   b. Do not exhaust flue gases directly into an enclosed area to prevent concentrated carbon dioxide from causing concrete carbonation.
   c. Provide continuous supervision of heating units when in use.
. Remove protection so concrete temperature drop does not exceed 2 degrees in any one hour and 40 degrees in the first 24 hours after protection removal.

3.03 SLAB OINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation oints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Saw Cut Contraction oints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4 the depth of the slab.

E. Separate slabs on grade from vertical surfaces with joint filler.

F. Place concrete continuously between predetermined expansion, control, and construction joints until complete. Do not permit more than thirty (30 minutes between depositing adjacent layers of concrete within each section.

G. Thoroughly compact, puddle, and vibrate concrete into corners and around reinforcing and embedded items.

H. Place sections of concrete in a sequence which eliminates the effect of shrinkage to greatest extent practicable.

I. Maintain concrete temperatures between sixty degrees and ninety degrees when placing and not less than fifty degrees for seventy-two hours after placing.

3.04 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch in 10 feet.
   2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
   3. Under Carpeting: 1/4 inch in 10 feet.

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.05 CONCRETE BONDING

A. To New Concrete Wall Hori ontal Construction oints:
   1. Thoroughly clean and saturate joint with water.
   2. Cover hori ontal wall surfaces with minimum 2 inches of cement-sand-water grout, (9 sack minimum and immediately place concrete.
   3. Limit concrete lift placed immediately on top of grout to 12 inches thick.
   4. Thoroughly vibrate to mix and consolidate grout and concrete together.

B. To Old Concrete:
   1. Mechanically roughen existing concrete surfaces to a clean, rough surface and provide a minimum roughness profile of □ -inch.
   2. Saturate surface with water for 24 hours, cover with 2 inches of grout, and place grout as specified for new concrete.

3.06 CONSTRUCTION OINTS

A. Locate construction joints as indicated. oints shall be located so as not to impair the structural integrity of the structure.

3.07 SURFACE PREPARATION

A. Construction oints: Prior to placement of abutting concrete, clean contact surface:
   1. Remove laitance and spillage from reinforcing steel, waterstops and dowels.
   2. Roughen surface to a minimum of 1/4 inch amplitude:
      a. Sandblast after the concrete has fully cured.
      b. Water blast after the concrete has partially cured.
      c. Green cut fresh concrete with high pressure water and hand tools.
   3. Perform cleaning so as not to damage water stop, if one is present.

3.08 PATCHING

A. General:
   1. Prior to starting patching work, obtain quantities of color-matched patching material and manufacturer's detailed instructions.
   2. Develop patching techniques with manufacturer on mockup panel.
   3. Dress surface of patches that will remain exposed to view to match color and texture of adjacent surfaces.

B. Tie Holes:
   1. Fill with nonshrink grout, except where sealant is shown. Use only enough water to dry pack.
   2. Match color of adjacent concrete.
   3. Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water.

C. Defective Areas:
   1. Remove defective concrete to a depth of sound concrete.
   2. If chipping is required, make edges perpendicular to surface with a minimum of 1/2-inch in depth. Do not feather edges. Obtain Engineer's approval of chipping work.

3. Patch defective area to match appearance of adjacent concrete surfaces.

D. Blockouts at Pipes or Other Penetrations:
1. Meet details shown or submit proposed blockouts for review.
2. Use nonshrink grout.

3.0 CONCRETE FINISHING

A. Notify Engineer of any Defective Concrete.

B. Repair surface imperfections, including tie holes, immediately after removing formwork.
1. Chip out honeycomb to sound concrete.
2. Remove all bulges, fins, and small projections by chipping or tooling.
3. Remove all undesired bolts, nails, ties, or other embedded metal to a depth of 1/2 inch from the concrete surface.
4. Remove scale, dirt or other coatings which may impair bond; comply with ACI 318.
5. Fill holes with patching mortar finished to match the surrounding concrete.
6. Adjust cement color as required so that the patches match the adjacent concrete.

C. Verify formwork joint offsets conform to ACI 11 , as previously defined under Preparation.

D. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

E. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
2. On below grade walls and members, provide specified finish a minimum of 1'-0" below final grade elevation.

F. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terra o with full bed setting system.
2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terra o, thin set quarry tile, and thin set ceramic tile.
3. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimi ing burnish marks and other appearance defects.

G. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

3.10 BAC FILL AGAINST ALLS

A. Do not backfill against walls until concrete has obtained 28 day compressive strength.

B. Place backfill simultaneously on both sides of wall, where required, to prevent differential pressures.

3.11 CURING AND PROTECTION

A. Immediately after finishing or stripping forms, apply continuous cover of polyethylene film.
1. Minimum Lap: Six inches (6" .
2. eep film in place for seven (days.

B. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

D. The following requirements shall be maintained until concrete has reached a minimum of 0 percent of its required compressive strength, or for days, whichever is longer:

1. Do not allow temperatures of the concrete to fall below 50 degrees F, nor rise above 90 degrees F.
2. Do not allow the temperature of the concrete surface to change more than 20 degrees F.
3. Maintain wet curing requirements.

E. The above requirements shall be maintained if forms remain in place, or have been removed in accordance with the Contract Documents.

F. Formed Surfaces: Cure by moist curing with forms in place for full curing period or with forms removed with moisture retaining cover or curing compound.
1. Curing compound must be compatible with specified finish schedule. Forms shall be stripped in accordance with current ACI code.
2. Cure surfaces in accordance with ACI 308R.
3. Spraying: Spray water over surfaces and maintain wet for days.
4. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in two coats, with second coat applied at right angles to first.

G. Surfaces Not in Contact with Forms:
1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. eep continuously moist for not less than three days by water ponding.
   a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.
   b. Spraying: Spray water over floor slab areas and maintain wet for days.
2. Final Curing: Begin after initial curing but before surface is dry.
   a. Moisture-Retaining Sheet: Lap strips not less than six inch and seal with waterproof tape or adhesive; secure at edges, maintain in place for not less than 4 days.
   b. Absorptive Moisture-Retaining Sheet: Saturate burlap-polyethylene and place burlap - side down over floor slab areas, lapping ends and sides; maintain in place for days.
   c. Membrane Curing Compound: Apply curing compound in accordance with manufacturer's instructions in two coats, with second coat applied at right angles to first.
   d. Curing by ponding, spraying or saturated sheet shall be used for all liquid-retaining structures (clarifiers, splitters, basins, etc. and for all other structures where possible. Membrane curing compound may be used for other structures if specifically requested by Contractor and approved by Engineer.

3.12 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

D. Compressive Strength Tests: ASTM C 39.
1. For each test, mold and cure four concrete test cylinders if 6" cylinders are used. Mold and cure five concrete test cylinders if 4" cylinders are used. Obtain test samples for every 30 cu yd or less of each class of concrete placed. Not less than one test per day
2. From each set of cylinders, an approved testing laboratory shall test one cylinder at days and two 6" cylinders (three 4" cylinders at 28 days. The final cylinder shall be properly stored until after the has reviewed the and 28 day tests. Unless otherwise specified, the day test shall be for informational purposes only. Concrete acceptance shall be based on the average of the two or three cylinders tested at 28 days.
3. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
4. Passing test shall be as defined in ACI 318.

E. Slump Tests: ASTM C 143.

1. A minimum of one slump test shall be taken for the first batch of concrete each day and for each set of test cylinders taken. Additional slump tests shall be taken whenever the consistency of concrete appears to vary.

F. Air-content Tests: ASTM C 231, C1 3, or C 138.
   1. A minimum of one air-content test shall be taken for each set of test cylinders taken. Additional air-content tests shall be taken whenever the proportions of the concrete mix change.

G. Concrete Temperature: ASTM C 1064.
   1. A record of concrete temperature shall be kept for each sample of concrete taken.

H. Method and application of curing shall account for concrete temperature, air temperature, relative humidity, and wind velocity. When evaporation rates exceed 0.2 lb/sq.ft/hour, precautions shall be taken to prevent plastic shrinking cracking. Use Figure 2 1.5 of ACI 305R for evaluating.

3.13 PROTECTION OF INSTALLED OR

A. After curing and applying final floor finish, cover slabs with plywood or particle board, plastic sheeting, or other material to keep floor clean and protect it from material and damage due to other construction work.

B. Patch and repair defective areas and areas damaged by construction.

3.14 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Engineer and Contractor within 24 hours of test.

B. Defective Concrete: Concrete with excessive honeycombing, embedded debris or concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Engineer. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.15 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections as directed.

END OF SECTION 03 3000

SECTION 22 0553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. List: Submit list of wording, symbols, letter si e, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady : www.bradyid.com.

B. Seton Identification Products: www.seton.com.

C. Champion America: www.chamption-america.com.

D. olbi Pipe Marker Co: www.kolbipipemarkers.com.

E. Engineer approved equivalent.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: Black.
   2. Letter Height: 1/4 inch.
   3. Background Color: Light contrasting color.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag si e minimum 1-1/2 inch square.

B. Metal Tags: Brass with stamped letters; tag si e minimum 1-1/2 inch diameter with smooth edges.

C. Chart: Typewritten letter si e list in anodi ed aluminum frame.

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following si e:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
   2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
   3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
   4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.

5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
6. Ductwork and Equipment: 2-1/2 inch high letters.

2.05 PIPE MAR ERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with plastic or metal tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify thermostats relating to terminal boxes or valves with nameplates.

I. Identify valves in main and branch piping with plastic nameplates or tags.

. Identify air terminal units and radiator valves with numbered tags.

. Tag automatic controls, instruments, and relays. ey to control schematic.

L. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

M. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

N. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 22 0553

SECTION 22 1005
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.

B. Sanitary waste piping, above grade.

C. Domestic water piping, buried within 5 feet of building.

D. Domestic water piping, above grade.

E. Storm drainage piping, buried within 5 feet of building.
   1. Storm drainage piping, above grade.
   2. Natural gas piping, buried within 5 feet of building.
   3. Pipe flanges, unions, and couplings.
   4. Ball valves.
   5. Butterfly valves.

1.02 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder oint Pressure Fittings.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder- oint Pressure Fittings.

C. ASME B16.23 - Cast Copper Alloy Solder oint Drainage Fittings - DWV.

D. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder oint Drainage Fittings - DWV.

E. ASME BPVC-I - Qualification Standard for Welding, Bra ing, and Fu ing Procedures; Welders; Bra ers; and Welding, Bra ing, and Fusing Operators - Welding Bra ing and Fusing Qualifications.

F. ASTM A 4 - Standard Specification for Cast Iron Soil Pipe and Fittings.

G. ASTM B32 - Standard Specification for Solder Metal.

H. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV .

I. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.

. ASTM B828 - Standard Practice for Making Capillary oints by Soldering of Copper and Copper Alloy Tube and Fittings.

. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

L. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride (PVC Plastic Piping Systems.

M. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride (PVC Plastic Drain, Waste, and Vent Pipe and Fittings.

N. ASTM D2855 - Standard Practice for the Two-Step (Primer Solvent Cement Method of oining Poly (Vinyl Chloride (PVC or Chlorinated Poly (Vinyl Chloride (CPVC Pipe and Piping Components with Tapered Sockets.

O. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride (PVC Sewer Pipe and Fittings.

P. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

Q. AWWA C651 - Disinfecting Water Mains.

R. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.

S. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

T. MSS SP- 0 - Cast Iron Gate Valves, Flanged and Threaded Ends.

U. MSS SP-85 - Cast Iron Globe Angle Valves, Flanged and Threaded Ends.

V. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder oint, Grooved and Flared Ends.

W. NSF 61 - Drinking Water System Components - Health Effects.

. NSF 3 2 - Drinking Water System Components - Lead Content.

. UL 23 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with State of Iowa standards.

B. Perform Work in accordance with the State of Iowa Standards and all local plumbing codes.

C. Valves: Manufacturer's name and pressure rating marked on valve body.

D. Welding Materials and Procedures: Comply with ASME BPVC-I and applicable state labor regulations.

E. Welder Qualifications: Certified in accordance with ASME BPVC-I .

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

1.06 ARRANTY

A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used , that comply with NSF 61 and NSF 3 2 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 23 tests.

2.02 SANITARY ASTE PIPING, BURIED ITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A 4 extra heavy weight.
   1. Fittings: Cast iron.
   2. oints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

2.03 SANITARY ASTE PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A 4, service weight.
   1. Fittings: Cast iron.
   2. oint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. oints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. Copper Tube: ASTM B306, DWV.
   1. Fittings: ASME B16.29, wrought copper, or ASME B16.23, sovent.
   2. oints: ASTM B32, alloy Sn50 solder.

2.04 DOMESTIC ATER PIPING, BURIED ITHIN 5 FEET OF BUILDING

A. Copper Tubing: ASTM B 88, Type , annealed.
   1. Fittings: ASME B16.22, wrought copper.

2. oints: ASTM B 32, solder, Grade 95TA.

2.05 DOMESTIC ATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B 88 (ASTM B 88M , Type (A in partitions and concealed above ceiling, Type L elsewhere, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bron e.
   2. oints: ASTM B32, alloy Sn95 solder.

2.06 STORM DRAINAGE PIPING, BURIED ITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A 4 extra heavy weight.
   1. Fittings: Cast iron.
   2. oint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.07 STORM DRAINAGE PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A 4 extra heavy weight.
   1. Fittings: Cast iron.
   2. oint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. oints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. oints: Solvent welded, with ASTM D2564 solvent cement.

2.08 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Si es 3 inch and Under:
   1. Ferrous Pipe: Class 150 malleable iron threaded unions.
   2. Copper Tube and Pipe: Class 150 bron e unions with soldered joints.

B. Flanges for Pipe Si es Over 1 inch:
   1. Ferrous pipe: Class 150 forged steel slip-on flanges.
   2. Copper tube and pipe: Class 150 slip-on bron e flanges or Victaulic couplings.

C. Dielectric Connections: Union with galvani ed or plated steel threaded end, copper solder end or Victaulic Clearflo, water impervious isolation barrier.

2.0 GATE VALVES

A. Manufacturers:
   1. Stockham.
   2. Engineer approved equivalent.

B. 2 Inches and Larger:
   1. MSS SP- 0, Class 125, iron body, bron e trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends. Provide chainwheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.10 GLOBE VALVES

A. Manufacturers:
   1. Stockham.
   2. Engineer approved equivalent.

B. 2 Inches and Larger:
   1. MSS SP-85, Class 125, iron body, bron e trim, handwheel, outside screw and yoke, renewable bron e plug-type disc, renewable seat, flanged ends. Provide chainwheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.11 BALL VALVES

A. Manufacturers:
   1. Conbraco Industries, Inc : www.apollovalves.com.

2. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.
3. Engineer approved equivalent.

B. Construction, 4 inch and Smaller: MSS SP-110, Class 150, 400 psi CWP, bron e or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

C. Up to 2 Inches: 2 piece bron e body, 400 psig WOG rated, stainless steel ball, Teflon seats and stuffing box ring, lever handle, solder or threaded ends with union. Provide balancing stops when used for balancing service.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges, unions, or grooved couplings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Provide brass nipple bra ed to ductile iron flange for transitions from ductile iron to copper. Do not use dielectric unions.

D. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

E. Install piping to maintain headroom, conserve space, and not interfere with use of space.

F. Group piping whenever practical at common elevations.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

I. Slope water piping and arrange to drain at low points.

. Provide access where valves and fittings are not exposed.

. Establish elevations of buried piping outside the building to ensure not less than 5 ft of cover.

L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of inc-rich primer to welding.

M. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.

N. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.

O. Excavate in accordance with Section 31 2316.

P. Install bell and spigot pipe with bell end upstream.

Q. Provide one plug cock wrench for every ten plug cocks si ed 2 inches and smaller, minimum of one. Provide each plug cock si ed 2-1/2 inches and larger with a wrench with set screw.

R. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 3 2.

S. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

3.03 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install globe valves for throttling, bypass, or manual flow control services.

3.04 DISINFECTION OF DOMESTIC ATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Ensure pH of water to be treated is between .4 and .6 by adding alkali (caustic soda or soda ash or acid (hydrochloric .

C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analy e in accordance with AWWA C651.

END OF SECTION 22 1005

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SECTION 22 1116.01
PIPING ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping Accessories, including: Flange Adapters.

1.02 REFERENCES

A. ANSI B16.5 - Pipe Flanges and Flanged Fittings.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 3000 - Administrative Requirements.

B. Submit the following as appropriate for each item provided.
   1. Outline and installation drawings for equipment and fixtures furnished.
   2. Equipment performance data and operating characteristics.
   3. Manufacturer's catalog data, marked to indicate materials being furnished as standard equipment, fixtures, specialties, and accessories.
   4. Shop Drawings on shop-fabricated systems.
   5. Drawings showing arrangement of piping, controls, and accessory equipment furnished.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Operation and Maintenance data as described in Section 01 800 - Closeout Submittals.

1.04 DELIVERY, STORAGE AND HANDLING

A. Arrange delivery of products in accordance with construction schedules and to allow inspection prior to installation.

B. Coordinate deliveries to avoid conflict with conditions at site.

C. Deliver products in undamaged condition in original containers or packaging, with identifying labels intact and legible.

D. Clearly mark to identify partial deliveries of component parts to facilitate assembly.

E. Store products immediately on delivery and protect until installed. Storage to be done according to manufacturer's instructions with seals and labels intact and legible.

F. Provide platforms, blocking or skids, or coverings required to protect products from deterioration or damage.

G. Arrange storage in a manner to provide easy access for inspection.

H. Maintain storage conditions to prevent deterioration or damage.

I. Protect products after installation to prevent damage from subsequent operations. Remove when no longer needed.

. Provide equipment and personnel necessary to handle products by methods to prevent damage to products or packaging.

. Handle products by methods to prevent bending or overstressing.

1.05 SERVICE REPRESENTATIVE

A. Available by telephone for questions regarding installation and operation.

1.06 ARRANTY

A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 PIPING ACCESSORIES

A. Flange Adapters: Where indicated on the drawings and in these specifications. The intended use is to connect flange joint valves, fittings, and pipe to a plain end pipe. Flange joint shall match dimensions of Class 125, ANSI B16.1 and capable of being joined to Class 150, ANSI B16.5. Unless otherwise indicated, flange adapters shall have thrust protection such as set screws or anchor studs. Adapters shall be watertight at a working pressure of 150 psi. Flange adapters shall be by Series 2100 Megaflange by EBAA Iron Sales, Inc., or Engineer approved equivalent.

B. Anchoring Pipe and Couplings: Where indicated on the drawings. May be utili ed for hydrant leads, branch line stubs, and dead ends, in conjunction with mechanical joint pipe, fittings, valves, and hydrants. Clow M anchoring pipe, couplings, and fittings or Engineer approved equivalent.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installed in accordance with Manufacturer's recommendations, as shown on the plans, by qualified craftsmen.

B. Location, orientation, and quantities as shown on the plans.

C. Include all required related items necessary for a complete installation.

D. Surface preparation shall follow the piping surface preparation specification. Contractor shall be responsible for compatibility of manufacturers shop coating and final finish.

E. Support independently or from piping.

END OF SECTION 22 1116.01

SECTION 22 111
PIPING, TUBING AND FITTINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Polyethylene Pipe, Tube and Fittings.

1.02 REFERENCES

A. ANSI BI.20.1 - Pipe Threads, General Purpose (Inch .
B. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
C. ANSI B16.3 - Malleable Iron Threaded Fittings Classes 150 and 300.
D. ANSI B16.4 - Cast Iron Threaded Fittings Classes 125 and 250.
E. ANSI B16.5 - Pipe Flanges and Flanged Fittings.
F. ANSI B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.
G. ANSI B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
H. ANSI B16.12 - Cast Iron Threaded Drainage Fittings.
I. ANSI B16.14 - Ferrous Pipe Plugs, Bushings, and Lock Nuts with Pipe Threads.
. ANSI B16.18 - Cast Cooper Alloy, Solder oint Pressure Fittings.
. ANSI B16.21 - Non-metallic Flat Gaskets for Pipe Flanges.
L. ANSI B16.22 - Wrought Copper and Copper Alloy Solder oint Pressure Fittings.
M. ANSI B16.24 - Bron e Pipe Flanges and Flanged Fittings Classes 150 and 300.
N. ANSI B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
O. ANSI B16.28 - Wrought Steel Buttwelding Short Radius Elbows and Returns.
P. ANSI B16.39 - Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300.
Q. ANSI B31.1 - Power Piping.
R. ASTM A4 - Standard Specification for Ferritic Malleable Iron Castings.
S. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, inc-Coated, Welded and Seamless.
T. ASTM A 4 - Standard Specification for Cast Iron Soil Pipe and Fittings.
U. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts.
V. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
W. ASTM A312 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
. ASTM A536 - Standard Specification for Ductile Iron Castings.
. ASTM B32 - Standard Specification for Solder Metal.
. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride (PVC Plastic Drain, Waste, and Vent Pipe and Fittings.
AA. ASTM D2 29 - Standard Specification for Poly (Vinyl Chloride (PVC Sewer Pipe and Fittings.
BB. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in., for Water and Other Liquids.
CC. AWWA C20 - Steel Pipe Flanges for Waterworks Service - Si es 4 in. Through 144 in.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 3000.
B. Product Data:

1. Submit catalog cuts, product specifications, and dimensioned drawings for each type of pipe, tube, and fitting.
2. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-applied basic end caps on each length of pipe and tube. Maintain end caps through shipping, storage, and handling as required to prevent pipe end damage and eliminate dirt and moisture from inside of pipe and tube.

B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

1.05 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of pipe, tube, and fittings of types and si es required, whose products have been in satisfactory used in similar service.

B. Welding: Quality welding procedures, welders, and operators in accordance with ANSI B31.1, Paragraph 12 .5, for shop and project site welding of piping work.

1.06 ARRANTY

A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. General: Provide pipe and tube of type, joint type, grade, si e and weight (wall thickness or Class indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.

2.02 POLYETHYLENE PIPE, TUBE, AND FITTINGS

A. Polyethylene pipe: PE 3408 high density, high extra molecular weight pipe conforming to ASTM D3350 specifications and having a cell classification of PE 345434C.

B. Standard thermoplastic pipe dimension ration (SDR equal to SDR 11 - Pressure class of 160 psi.

C. Chemical resistance: Resistant to Chlorine solutions.

D. oints: Butt fusion welded.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:
   1. Install pipe, tube, and fittings in accordance with recogni ed industry practices achieving permanently leakproof piping systems, capable of performing each indicated service without piping failure.
   2. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment.
   3. Reduce si es (where indicated by use of reducing fittings.
   4. Align piping accurately at connections, within 1/16 inch misalignment tolerance.
   5. Comply with ANSI B31.1 - Code for Pressure Piping.

B. Piping Runs:
   1. Locate piping runs, except as otherwise indicated, vertically and hori ontally (pitched to drain and avoid diagonal runs wherever possible.
   2. Orient hori ontal runs parallel with walls and column lines.

3. Locate runs as shown or described by diagrams, details, and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and equipment.
4. Hold piping close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building; limit clearance to 1/2 inch where furring is shown for enclosure for concealment of piping, but allow for insulation thickness, if any.
5. Where possible, locate insulated piping for 1.0 inch clearance outside insulation.
6. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, hollow wall construction or above suspended ceilings.
. Do not encase hori ontal runs in solid partitions, except as indicated.

C. Electrical Equipment Spaces:
1. Do not run piping through electrical or electronic equipment spaces and enclosures unless unavoidable.
2. Install drip pan under piping that must be run through electrical spaces.

D. Piping System oints: Provide joints of type indicated in each piping system.
1. Thread pipe in accordance with ANSI BI.20.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound or pipe joint tape (Teflon where recommended by pipe/fitting manufacturer, on male threads at each joint, and tighten joint to leave not more than 3 threads exposed.
2. Bra e copper tube and fitting joints where indicated, in accordance with ANSI B31.1.
3. Solder copper tube and fitting joints where indicated, in accordance with recogni ed industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of tubes and fittings. Insert tube full depth into fitting, and solder in manner drawing solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
4. Weld pipe joints in accordance with ANSI B31.1.
5. Weld pipe joints of steel water pipe in accordance with AWWA C206.
6. Flanged oints: Match flanges within piping system and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
. Hubless Cast Iron oints: Comply with CISPI 310.
8. Grooved Pipe oints: Comply with fitting manufacturers instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.

3.02 CLEANING, FLUSHING, INSPECTING

A. General: Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings (if any . Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
1. Inspect pressure piping in accordance with procedures of ANSI.

3.03 FIELD QUALITY CONTROL

A. Piping Tests:
1. General: Provide temporary equipment for testing, including pump and gauges. Test piping system before insulation is installed wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressuri e for indicated pressure and time.
a. Required test periods is 2 hours.
b. Test each pressure piping system at 150 of operating pressure indicated, but not less than 25 psi test pressure.
c. Observe each test section for leakage at end of test period. Test fails if leakage observed or pressure drop exceeds 5 of test pressure.

2. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics or other temporary repair methods.
3. Drain test water from piping systems after testing and repair work complete.

END OF SECTION 22 111

SECTION 25 1300
INSTRUMENTATION AND CONTROL INTEGRATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Integration of instrumentation and controls system, provided by a single systems integrator, furnishing and activating items specified in Sections 25 1300.

B. The VFDs specified in Section 26 2923 shall be supplied by the pump supplier. Refer to Section 26 2923 for coordination requirements.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. The Submittals shall consist of legible printed text, high quality drawings, and manufacturer's catalog data bound in an electronic PDF (indexed, book marked, and searchable , that identify major sections of the document. The Submittals shall address all hardware and software to be supplied.

C. The Submittals shall contain:
   1. Identification of the respective responsibilities of each party to the project, including what is provided by the system manufacturer, what is to be subcontracted, etc.
   2. Description of the major user related features and operating characteristics of the proposed system.
   3. Description of all master site hardware and software, including examples of digital displays, control loops, reports, and how the operator will interface with the system to achieve each specified function.
   4. Description and operation of all master configuration features of the I/O and local control loop characteristics.
   5. Describe the training program. An outline shall be provided that covers the basic software and hardware training, operator training, system maintenance training, and programming training. Identify the course content and the time spent on each subject area.
   6. Describe the startup implementation plan, participants' responsibilities and a schedule of events.
   . All significant equipment to be supplied shall be listed, followed by descriptive data sheets. The equipment list shall include each component name, manufacturer, model number, a description of the operation, quantity supplied, and any special setup and operation and maintenance characteristics.
   8. Drawings of equipment to be supplied shall include as a minimum, overall dimensions and details for each unit, including installation arrangements, door mounted operator devices, and instruments. Wiring diagrams of all system components, including field device connections, shall be included and specific installation wiring responsibilities identified.
   9. Detailed written sequences of operation describing pre-startup, normal operation, shutdown, and emergency shutdown procedures.
   10. Detailed factory and field test procedures at least two weeks before scheduled testing.
   11. Color printout of all SCADA screens to be provided. Integrator shall include two (2 trips and two (2 meetings on-site at the Owners location during the development of screens for review of work product to date and direction for further work.
   12. Recommended maintenance, special tools, and test equipment.
   13. Hardware configuration block diagrams.
   14. Network diagrams.

D. Operation and maintenance manuals.

1.03 MAINTENANCE MANUALS AND RECORD DRA INGS

A. O M Manuals shall be provided as specified in Section 01 800. In addition to those requirements, specific additional details as indicated below shall be provided.

B. Provide detailed O M manuals with complete information concerning the operation of the system and support necessary, with diagnostics down to the module and card replacement level.

C. Provide a detailed written description of system hardware, software, and system operation. The description of master site hardware and software shall identify pertinent references to sections of standard hardware and software manuals where operational procedures are detailed. Control loops shall be fully described in the O M manual.

D. Submit four sets of complete O M manuals with all project specific information in binders with indexed tab sections. Include manufacturer/supplier, contact and phone number for all equipment listed. Submit a digiti ed version of complete O M manuals on disk or CD.

E. A listing of all recommended spare parts shall be included in the O M manuals.

F. Data sheets shall be supplied for all significant equipment used in the system. The data sheet shall include, as a minimum, the component name, manufacturer, model number, quantity, and any special O M characteristics.

G. Final record drawings of equipment shall be provided and as a minimum to include:
   1. Overall dimensions and details for all equipment and all door mounted operator devices including nameplate designations.
   2. Interconnecting wiring diagrams of all master station equipment, including field device connections.
   3. PLC and OIT programs including well documented ladder logic program, flow chart, address list, and passwords (electronic .

H. Detailed written sequences of operation describing pre-startup, startup, normal operation, shutdown, and emergency shutdown procedures.

I. Alarm list:
   1. Provide list of process alarms as configured.
   2. Provide list of PLC and SCADA equipment and communications alarms as configured and indicate likely source of problem.

. PLC and SCADA programs and graphics documentation: commented, fully documented and cross-indexed ladder diagrams and screen configurations.

. Equipment and software manuals:
   1. Equipment list identifying components, model numbers, and release levels.
   2. Operation and maintenance data for each hardware and software component.
   3. Programming/configuration instructions for components.

L. Guides for locating faults, symptoms, possible causes of trouble, and suggested remedial action.

M. Detailed instructions on operation of utility programs.

N. Documentation concerning system software development:
   1. Diagrams, code annotation, and other pertinent documents to define system.
   2. Listing of screens included in system.
   3. Color printout of all screens.
   4. Database structures, views, tables, and indexes.
   5. List of constants and variables with descriptions.
   6. Passwords.
   . Network Addresses.

O. Documents pertaining to factory and field testing efforts.

P. Equipment lists including manufacturer's name, part number, serial number, revision number, and recommended spare parts.

Q. Communication parameters needed to interface with other computers (speed, number of data bits, parity, modem control, etc. .

1.04 ARRANTY

A. Full warranty against defects in materials and workmanship for one year after substantial completion, including all parts, labor, and expenses.

1.05 MAINTENANCE CONTRACT

A. The Systems Integrator may offer the Owner a maintenance contract on the system.

B. The contract shall provide for recommended preventive maintenance, required emergency maintenance and the supply of all consumable items and parts of components which may fail during the life of the contract, and shall be dated to begin when the warranty period expires.

C. The Owner reserves the right to accept or reject the maintenance contract.

D. The maintenance contract cost shall not be included as part of this project, but shall be an item negotiated between Owner and systems integrator.

1.06 START-UP BY SERVICE REPRESENTATIVE

A. Provide qualified service representative to perform functions described in 01 4000 and the following.

B. Provide for equipment installation check, calibrations, control adjustments, startups, and other services in the field by qualified service representative to produce complete working installation in compliance with drawings and specifications, satisfactory to Owner and Engineer.

C. Provide field startup service at the project site.

D. This field service is to cover both the separate mounted instrumentation involved in the system and the various control panels and components.

E. Coordinate with General Contractor, Sub-Contractors and Equipment Suppliers to provide start-up services in concert with other equipment in the project.

F. In addition to the field services, arrange for Owner training to be performed by the Manufacturer in the use and maintenance of all instrumentation and control system equipment supplied. Refer to scheduled training requirements.

G. Provide complete start-up services until all systems are fully functional.

H. Any additional trips and/or days required by the Contractor before or after final startup and training shall not be charged to the Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 INSTALLATION

A. All units shall be installed in accordance with manufacturer's recommendations and Section 46 0500, and as indicated on drawings.

B. Units shall be installed and programmed by well qualified and experienced craftsmen and engineers/technicians.

C. Locations, orientations, and quantities as indicated on drawings.

D. Units shall be properly interfaced with the input and output devices.

E. Electrical and control wiring, cabling, conduits, connections, etc. shall be neatly installed.

F. Include all required and related items for a complete installation.

G. Support and anchor all units as per the manufacturer's recommendations and as indicated on drawings.

3.02 RESPONSIBILITY

A. The instrumentation and control integrator shall be responsible for coordination of the control center components, instrumentation, and supervisory controls with the process equipment installed.

B. Provide complete shop drawings and wiring diagrams.

C. To ensure a complete and totally integrated system, a single manufacturer who has had at least five years experience in furnishing similar microprocessor based control and telemetry systems, shall supply all specified equipment and services. This shall include: hardware, software, programming, installation coordination, startup, training, and warranty services as required. The manufacturer shall have successfully completed at least ten similar si ed non-proprietary PLC-based telemetry, instrumentation and controls systems.

D. To ensure an integrated and operational control system it is required that one system integrator shall supply all necessary control equipment and employ the personnel necessary to provide and support the complete system.

E. Systems Integrator's service organi ation must stock parts for equipment supplied and be available within 24 hours of verbal notice on all days of the week to provide free service during the guarantee period. System integrator's organi ation shall include the full complement of engineering, manufacturing, and field services.

F. Service shall also be available 24 hours per day, 365 days per year.

3.03 SYSTEMS INTEGRATOR

A. Shall be an Allen-Bradley authori ed systems integrator.

B. Shall have successfully configured and installed at least ten (10 networked systems of similar si e, scope, and complexity in water/wastewater plant applications.

C. Shall provide project engineer for programming the PLCs and SCADA software on this project who is formally trained and experienced with Allen-Bradley and Wonderware or Intellution software.

D. Experience shall include multiple PLCs, networking on CAT 6 and fiber optic, WAN/LAN networks with multiple SCADA workstations, graphical screens, reporting, operating systems, etc.

END OF SECTION 25 1300

SECTION 26 0500
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Division 26.

B. The general provisions of this Section apply to the other Division 26 sections.

C. The work shall include the furnishing of systems, equipment and materials specified in this Division and as called for on the Drawings, to include: supervision, operation, methods and labor for the fabrication, installation, startup and tests for the complete electrical installation.

D. Drawings for the Work are diagrammatic, intended to convey the scope of the Work and to indicate the general arrangement and locations of the Work. Because of the scale of the Drawings, certain basic items such as connectors, fittings, access panels, pullboxes, etc. are not necessarily shown. Where such items are required for proper installation of the Work, such items shall be included.

E. Equipment specifications may not deal individually with minute items required such as components, parts, controls and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether or not specifically called for.

F. Where noted on the Drawings or where called for in other sections of the Specifications the Contractor shall install equipment under this Contract and shall make required electrical connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.

1.02 OR BY OTHERS

A. The Owner may award contracts which will run concurrent to the Work.
   1. See notes on plans for extent of Division 26 participation.

1.03 O NER FURNISHED PRODUCTS

A. Products furnished to the site and paid for by Owner shall be as noted on Drawings.

1.04 CONTINUITY OF SERVICE

A. Coordinate Work to accommodate Owner's occupancy requirements during the construction period. Refer to Section 01 1000 - Summary for additional requirements.

1.05 ACTIVE SERVICES

A. Existing active services: water, gas, sewer, electric, when encountered, shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to authorities having jurisdiction for determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the Owner.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Submittal data for electrical equipment shall consist of shop drawings and/or catalog cuts showing technical data necessary to evaluate the material or equipment, to include power requirements (wattage, voltage, amperage, power factor, etc. dimensions, wiring diagrams, performance curves, ratings, (electrical, environmental, etc. , control sequences and other descriptive data necessary to describe fully the item proposed and its operating characteristics. Shop drawings shall be submitted for equipment and materials as directed in individual sections.

C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.

D. The Engineer will review shop drawings to aid in interpreting the Contract Documents, and will in so doing assume that the shop drawings conform to all specified requirements set forth in the Contract Documents. The review of the shop drawing by the Engineer does not relieve the Contractor of the responsibility of complying with all elements of the Contract Documents.

1.07 REGULATORY REQUIREMENTS

A. Imposed Standards/Regulations:
   1. General: Applicable provisions of the following codes and standards are hereby imposed on a general basis for the electrical work in addition to specific applications specified by individual work sections of the Specifications.
      a. Underwriters Laboratories (UL .
      b. NFPA 0: National Electrical Code (NEC .
      c. NFPA Standards and Pamphlets.
      d. Local and State Electrical, Mechanical and Building Codes as they apply.
   2. Every installation shall also comply with applicable Divisions and Sections of this Specification. If changes are required to attain compliance, the Contractor shall submit the proposed changes to the Owner and Engineer for review and approval. If approval for the change is obtained, revised submittal data shall be provided for review.
   3. Installations must be safe in every respect, and must not create any condition which will be harmful to building occupants, operating personnel, installation personnel, testing personnel, construction workers, and general public. If Contractor believes that the installation will not be safe for all parties, the Contractor shall so report in writing to the Engineer, stating the issues and conditions and possible remedies, before any equipment is purchased or installed.
   4. The manufacturer of each type of equipment, used by itself or as a part of any system, shall carefully check capacities, arrangements, and methods shown or specified (including space requirements, servicing requirements, ambient air temperatures, etc. for installation of the equipment, and all connections to other system or to parts of same system to assure that when used, connected, interconnected, piped, wired, or controlled as specified, the equipment can be properly serviced. If the manufacturer has any reservations in this regard, the manufacturer shall state such reservations and any suggested changes to the Engineer as a part of the shop drawing submission.
   5. Engineer will work out required changes and adjustments in Contract Prices where such adjustments are warranted. No adjustments in Contract Price will be allowed for additions required by applicable code, ordinance, statute, utility regulation, or labor regulation. It is the obligation of the Contractor to include such items in the original Bid. Changes in equipment shall be incorporated in shop drawings. If Contractor fails to call such reservations or suggestions to Engineer's attention, in writing, before any work is done or equipment is purchased, it will be assumed that the Contractor accepts responsibility for providing a completely safe and completely coordinated installation. If at a later date changes become necessary to assure a completely safe and coordinated installation, they shall be made, as approved by Engineer, without increase in Contract Price.

B. Permits and Tests, Electrical Work: Unless otherwise noted in the detailed contractual description preceding these technical specifications, the Contractor shall secure all permits and pay all fees required in connection with this installation and shall be responsible for securing such inspections as are required by the authorities with jurisdiction over the site. Submit a record copy to the Owner and the Engineer of electrical work notices, permits, licenses, inspection or test reports, and similar items obtained in response to governing and imposed regulations and standards.

1.08 PRO ECT CONDITIONS

A. Inspect site prior to bidding to be thoroughly familiar with existing conditions.

B. Install Work in locations shown on Drawings, unless prevented by Project conditions.

C. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Engineer before proceeding.

D. All Contractors shall familiari e themselves with the site and with any conditions of the site and/or existing buildings which might present unusual aspects to the work involved. Contractor shall verify all aspects of electrical work, insofar as is possible, check routes of conduit indicated, verifying clearances and other obstacles which might influence the construction proposed. No extras can be allowed on work occasioned by the Contractor's failure to make this inspection.

1.0 SEQUENCING AND SCHEDULING

A. Install work to accommodate Owner's occupancy requirements during construction period and coordinate electrical schedule and operations with Owner.

B. Construct Work in sequence under provisions of Division 1 - General Requirements and other Sections as applicable.

C. Completion of Electrical Work shall be coordinated with other trades and contractors to expedite completion of the Project.

D. The Contractor shall coordinate the placing of openings in the structures as required for the installation of the Electrical Work.

E. It will be the Contractor's responsibility to examine the Drawings and Specifications, to take measurements where required, to verify dimensions for correct placement of equipment and to progress the Contract as expeditiously as possible, so that the progress of the work is orderly and does not cause unnecessary cutting and patching of the structure. The Contractor shall be pecuniarily responsible for the cutting and patching of the structure occasioned by failure to install sleeves, grilles or other items required by the Electrical Work at the proper time for the normal installation of such items.

F. The Contractor shall provide cutting and patching and patch painting of the structure, as required for the installation of the Work, and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Engineer. Extent of cutting shall be minimi ed; use core drills, power saws or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

G. The determination of quantities of material and equipment required shall be made by the Contractor from the Contract Documents. Schedules on the Drawings and in the Specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.

1.10 OPENINGS, CUTTING, AND PATCHING

A. The Contractor shall coordinate the placing of openings in structures, as required, for the installation of the Electrical Work.

B. The Contractor shall coordinate the accurate locations and si es for required openings, and shall have the responsibility of checking to assure that proper si e openings are provided. When additional patching is required due to the Contractor's failure to inspect the work, then the Contractor shall make arrangements for the patching required to properly close the openings, to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.

C. When cutting and patching of the structure is made necessary due to the Contractor's failure to install conduit wiring or equipment on schedule, or due to the Contractor's failure to furnish, on schedule, the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements for the cutting and patching and the Contractor shall pay any additional cost incurred in the correction.

D. The Contractor shall provide cutting, patching and patch painting as required for the installation of Work in existing structures, and shall furnish lintels and supports as required for openings.

E. Cutting of structural support members will not be permitted without prior approval of the Engineer. Extent of cutting shall be minimi ed; use core drills, power saws or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

1.11 ALLO ANCES

A. Cash Allowance: Refer to other Sections and Plans for allowance sum applicable to Work (if any .

B. Allowance includes purchase, delivery and installation and is to be included as part of the Contract Price.

1.12 CONCRETE OR

A. The Contractor shall coordinate si e and location of concrete bases and pads for electrical equipment with the required trades and with the Utility.

B. The Contractor shall furnish equipment anchor bolts and shall be responsible for their proper installation and accurate location.

1.13 IRING FOR ELECTRICAL EQUIPMENT

A. The Contractor will provide power services for motors and equipment furnished by the Mechanical Contractor to include safety disconnect switches and final connections.

B. The Contractor will be responsible for power wiring, internal wiring, alarm wiring, control wiring or interlock wiring of all equipment installed or modified under this Contract.

C. This Contractor will furnish motor starters for motors furnished by the Mechanical Contractor, except where other Sections call for starters to be furnished by the Mechanical Contractor.

D. The Contractor shall review the Drawings and shall call to the attention of the Engineer, prior to bidding, omissions of electrical services required for this equipment.

1.14 PROTECTION

A. Special care shall be taken for the protection of equipment furnished by the Contractor. Equipment and material shall be completely protected from weather elements, painting, plaster, etc. until the Project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition.

B. Protection of equipment during the plastering and painting of the building shall be the responsibility of the Contractor performing that work, but this shall not relieve the Contractor of the responsibility of checking to assure that adequate protection is being provided.

C. Where the installation or connection of equipment requires the Contractor to work in areas previously finished, the Contractor shall be responsible that such areas are protected and are not marred, soiled or otherwise damaged during the course of such work. The Contractor shall repair and refinish such areas which were damaged due to work performed by the Contractor.

D. When heavy materials must be placed upon or transported over the roof deck, sheeting shall be placed to distribute weight and support such materials.

1.15 FINISHING

A. Prior to acceptance of the installation and final payment of the Contract, the Contractor shall perform the work outlined herein.

B. Perform cleaning required by Division 1 applicable to this Division of the Work. Cleaning shall include removing debris and dirt from panels, pull boxes, junction boxes, and other enclosures.

C. Operation and Maintenance Manuals: Prepare and submit Operation and Maintenance manuals as described in Division 1 and related sections in Division 26.

1.16 TEST AND DEMONSTRATIONS

A. Systems shall be tested and placed in proper working order prior to demonstrating systems to Owner.

B. Prior to acceptance of the electrical installation, the Contractor shall demonstrate to the Owner or designated representatives all essential features and functions of all systems installed, and shall instruct the Owner in the proper operation and maintenance of such systems.

C. Contractor shall furnish the necessary trained personnel to perform the demonstrations and instructions and shall arrange to have the manufacturer's representatives for the system present to assist with the demonstrations. The Owner and Contractor shall each sign a certification stating that the training has been performed and the Owner accepts same.

1.17 PAINTING AND IDENTIFICATION

A. Painting of electrical enclosures (switch/outlet boxes, starters, disconnects, control cabinets and panelboards shall be touch-up only of factory finish or finish specified elsewhere.

B. Conduit and raceway systems shall be unpainted unless specifically noted. If painting of conduit and raceway systems is required, coat with paint type and color to match background mounting surface.

C. Identify panels, switchgear, starters, switches, valves and dampers with engraved nameplates.

D. Provide typed panel and switchboard schedules.

E. Provide plastic "Buried Electrical" warning tape in trench above all underground circuit runs. Place approximately 18 inches below finished grade.

1.18 PRODUCT QUALITY, PERFORMANCE, AND SUBSTITUTIONS

A. All materials shall be the standard product of a reputable manufacturer regularly engaged in the manufacture of the specific product, and where more than one unit is required of the item, all shall be of the same manufacturer.

B. Proposals as submitted shall be based on the products specifically named in the specifications.

C. If specific products of more than one manufacturer are specified, the choice of these shall be made optional with the Contractor.

D. All materials are subject to approval by the Engineer both before and after incorporation in the building.

E. Should suppliers of materials not specified wish to bid their material as a base bid equal, they shall secure the written approval of the Engineer that their product is acceptable as an equal to that specified at least ten (10 days in advance of the bid date to have their products covered in an Addendum prior to opening of bids.

F. The Engineer reserves the right to refuse approval on equipment which does not meet the specification. Any materials not conforming to the specification may be ordered removed any time during the course of construction, and the Contractor shall replace such items, when notified, at the Contractor's expense. The Engineer further reserves the right to reject equipment for which the availability of maintenance service and replacement parts is questionable.

G. All materials and equipment shall be new. Second-hand, used, or salvaged equipment will not be allowed unless specifically noted.

H. All elements of the construction shall be performed by workmen skilled in the particular craft involved, and regularly employed in that particular craft. All work shall be performed in a neat, workmanlike manner in keeping with the highest standards of the craft.

I. The Engineer reserves the right to determine space priority of the equipment in the event of interference between the piping and equipment of the various installations. Conflicts between the Drawings and Specifications, or between requirements set forth for the various trades shall be called to the attention of the Engineer. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required and that the Contractor has submitted the bid in conformance with Contract Documents as issued.

1.1 EXCAVATING, TRENCHING AND BAC FILLING

A. The Contractor shall do excavating necessary for underground electrical ducts, wiring, manholes, conduit, etc., and shall backfill such trenches and excavations after equipment has been installed and tested. Care shall be taken in excavating, that walls and footings and adjacent load bearing soils are not disturbed, except where lines must cross under a wall footing. Where a line must pass under footing, the crossing shall be made by the smallest possible trench to accommodate the pipe.

B. Excavation shall be kept free from water by pumping if necessary. No greater length of trench shall be left open, in advance of pipe and utility laying, than necessary.

C. Immediately after testing and/or inspection, the trench shall be carefully backfilled. Place backfill into trench so the impact on installed pipe is minimi ed. Backfill and compact to specifications described in Division 2 for utility trenching.

1.20 COORDINATION

A. Where the Contract Documents state that equipment shall be "furnished", "installed", or "provided", it shall be understood to mean the Contractor shall furnish and install completely unless otherwise noted.

1.21 EXISTING SERVICE

A. If existing services are encountered in the Work, protect, brace, and support existing active sewers, gas, electric, or other services where required for the proper execution of the Work. If existing active services are encountered that require relocation, make request to proper authorities for determination of procedure. Do not prevent or disturb operation of active services that are to remain.

1.22 TEMPORARY SHUTDO NS OR ABANDONED SERVICES

A. Where the Work makes temporary shutdowns or need to abandon unavoidable, Contractor shall consult with the Owner as to times and procedures for such shutdowns. Where existing services are to be abandoned, wiring shall be removed and conduit shall be properly capped in conformance with requirements of the Utility.

1.23 SITE

A. The site shall be kept orderly and clean at all times during the construction and the storing of materials shall be in accordance with the requirements of the Owner in areas designated for that purpose. At the conclusion of the construction, the site shall be cleaned thoroughly of all rubble, debris and unused materials and shall be left in good order. All tunnels, chases or closed off spaces shall be cleaned of all waste materials, wood frame members, etc. used in construction.

1.24 NOISE AND VIBRATION

A. Electrical equipment shall operate without objectionable noise or vibration as determined by the Engineer. If such objectionable noise or vibration should be produced and transmitted to occupied portions of the building by apparatus, conduit, ducts or other parts of the electrical work, the Contractor shall make necessary changes and additions, as approved by the Engineer.

1.25 EQUIPMENT INSTALLATION

A. Erect equipment in neat and workmanlike manner, align, level and adjust for satisfactory operation, install so that connecting and disconnecting parts can be made readily and so that all parts are easily accessible for inspection, operation and maintenance.

1.26 APPLICATIONS

A. Where applications are required for the procuring of utility service to the building, the Contractor shall see that such application is properly filed with the Utility and that all information required for such an application is presented to the extent and in the form required by the Utility Company.

1.27 RECORD UTILITIES DRA INGS

A. Contractor shall prepare and submit to Engineer drawings showing the exact location of all installed underground electrical and conduit runs and any existing underground utilities encountered during installation. The drawings shall give accurate locations (referenced to visible above-grade objects and dimensions of all such equipment for future use by the Owner. These drawings shall be submitted to the Engineer as soon as practicable after such runs have been installed.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 26 0500

SECTION 26 051
LO -VOLTAGE ELECTRICAL PO ER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Wire and cable for 600 volts and less.

C. Wiring connectors.

D. Electrical tape.

E. Heat shrink tubing.

F. Wire pulling lubricant.

1.02 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.

D. ASTM B 8 /B 8 M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation.

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction.

G. NEMA WC 0 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.

I. NFPA 0 - National Electrical Code.

. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards.

. UL 44 - Thermoset-Insulated Wires and Cables.

L. UL 83 - Thermoplastic-Insulated Wires and Cables.

M. UL 444 - Communications Cables.

N. UL 486A-486B - Wire Connectors.

O. UL 486C - Splicing Wire Connectors.

P. UL 486D - Sealed Wire Connector Systems.

Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.

R. UL 854 - Service-Entrance Cables.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate si es of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor si es increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available si es, configurations, and stranding.

C. 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.

D. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 0.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Engineer and obtain direction before proceeding with work.

B. Perform Work in accordance with NECA Standard of Installation.

C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site.

B. Accept wires and cables on site. Inspect for damage.

C. Protect wires and cables from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.0 ARRANTY

A. Full warranty against defects in materials and workmanship for two (2 years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Alan Wire Company.

B. Belden, Inc.

C. Cablec.

D. Carroll.

E. Southwire Company.

F. Triangle.

G. Engineer approved equivalent.

2.02 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 0 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. All conductors/circuits shall be copper conductor. Use of aluminum conductors shall not be allowed unless specifically noted.

D. All circuits shall be installed as building wire, control wire, or signal cable in raceway unless specifically noted or indicated on the Drawings.

2.03 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 0.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 0.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

H. Conductor Material:
1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor si es indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B 8 /B 8 M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

I. Minimum Conductor Si e:
1. Branch Circuits: 12 AWG.
2. Control Circuits: 14 AWG.

. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
   a. Conductors si e 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
   a. 240/120 V, 1 Phase, 3 Wire System:
      1 Phase A: Black.
      2 Phase B: Red.
      3 Neutral/Grounded: White.
   b. Equipment Ground, All Systems: Green.
   c. Travelers for 3-Way and 4-Way Switching: Purple.
   d. For control circuits, comply with manufacturer's recommended color code.

2.04 SINGLE CONDUCTOR BUILDING IRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
1. Feeders and Branch Circuits: Stranded.
2. Control Circuits: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
   a. Si e 4 AWG and Larger: Type HHW-2.
   b. Installed Underground: Type HHW-2.
   c. Between VFD outputs and motors: Type HHW-2, unless specifically indicated otherwise.

E. All wire routed through underground raceway shall be listed for wet location.

2.05 IRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Si e 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Si e 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Where over-si ed conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate si e, but not less than required for the rating of the overcurrent protective device.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

H. Mechanical Connectors: Provide bolted type or set-screw type.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.06 ACCESSORIES

A. Electrical Tape:
   1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
   2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
   3. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Wire Pulling Lubricant:
   1. Listed and labeled as complying with UL 26 .
   2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
   3. Suitable for use at installation temperature.

2.07 CONTROL AND SIGNAL CABLE

A. Cable for Discrete Control Signals:
   1. Single conductor, 14 AWG stranded copper, type THHN/THWN insulation.

B. Signal Cable for Analog Control Signals:
   1. One twisted shielded pair 18 AWG, 300V - Belden 8 60 or equal.
   2. One twisted shielded triad (3-conductors , 18 AWG, 300V - Belden 8 0 or equal.

C. Ethernet Copper Cable for ordinary locations-DSC1:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568-C.2 and listed and labeled as complying with UL 444.

2. Cable Type - Voice and Data: TIA-568-C.2 Category 6 UTP (unshielded twisted pair ; 23 AWG.
3. Cable Capacity: 4-pair.
4. Cable Applications:
   a. General Purpose Applications: Use listed NFPA 0 Type CM/CMG general purpose cable, Type CMR riser cable, or Type CMP plenum cable.
5. Cable acket Color - Voice and Data Cable: Blue.
6. Product(s :
   a. Belden 92 A
   b. Engineer Approved Equivalent.
. Termination: Cable shall be terminated within control panel or device with a female R 45 connector and utili e a R 45 male to male CAT 6 jumper for final connection to switch or device.

D. Ethernet Copper Cable for locations with 600V - DSC2:
1. Description: Industrial Ethernet Cat 6, 4 Bonded-Pair 23AWG (Solid Bare Copper, PO Insulation, Overall Beldfoil□ Shield, PVC Inner acket, PVC Outer acket, MSHA, CM - Outdoor 600V
2. Description: 100 ohm, balanced twisted pair cable complying with TIA-568-C.2 and listed and labeled as complying with UL 444.
3. Cable Type - Voice and Data: TIA-568-C.2 Category 6 UTP (unshielded twisted pair ; 23 AWG.
4. Product(s :
   a. Belden 953A
   b. Engineer Approved Equivalent.
5. Termination: Cable shall be terminated within control panel or device with a female R 45 connector and utili e a R 45 male to male CAT 6 jumper for final connection to switch or device. umpers in VFD's or panels with 600V wiring present shall be rated for 600V.

2.08 CORDS

A. Oil-resistant thermoset insulated multiconductor flexible cord with identified equipment grounding conductor, suitable for extra-hard usage in damp locations.

2.0 DATA CABLE

A. Unshielded Twisted Pair (UTP , High Performance (enhanced Category-5, 4-pair, plenum rated, UL Type CMP, 24 AWG, Solid copper. Blue jacket color.

B. Product: Avaya 2061 LAN Cable

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly si ed to accommodate conductors and cables in accordance with NFPA 0.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as indicated.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Verify conduit systems are ready to accept cables.

B. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimi e splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 0.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 0.
. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship .

D. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 0 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

G. Install conductors with a minimum of 6 inches of slack at each outlet.

H. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

I. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 0.

. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
2. Damp Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
    a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.

3. Wet Locations: Use heat shrink tubing.

L. Insulate ends of spare conductors using vinyl insulating electrical tape.

M. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

N. Identify conductors and cables in accordance with Section 26 0553.

O. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

P. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.

Q. All interconnecting circuit wires or cables (power and control shall be tagged with an appropriate numbering system that assigns a unique identification to the wire or cable that is compatible with the tagging system of the connected equipment. Tags shall be applied at all junctions and terminations of each wire or cable.

R. Install a waterproof sealant (such as silicone rubber in conduits connected to control valves, instrumentation, and other electrical power and control devices mounted directly to water piping. Inject sealant near end of flexible conduit connected to device. Install sealant after all power and control conductors have been installed and operation of equipment has been verified.

S. Route wire and cable as required to meet project conditions.

T. Pull all conductors into raceway at same time.

U. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

V. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.

W. Neatly train and lace wiring inside boxes, equipment, and panelboards.

. Clean conductor surfaces before installing lugs and connectors.

. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

. Terminate spare conductors with electrical tape and label as such.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Perform inspection, testing, and adjusting in accordance with Section 01 4000.

C. Perform field inspection and testing in accordance with Section 01 4000.

D. Perform inspections and tests listed in NETA ATS, Section .3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

E. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 26 051

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SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Ground access wells.

G. Wire, components, and miscellaneous equipment in supplying and installing electrical grounding systems.

H. Provide all components necessary to complete the grounding system(s consisting of:
   1. Metal underground water pipe.
   2. Ground rings.
   3. Rod electrodes.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings.

C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.

D. NFPA 0 - National Electrical Code.

E. UL 46 - Grounding and Bonding Equipment.

F. TIA/EIA-60 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of existing underground metal water service pipe entrances to building.
   2. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction are complete.

1.05 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.06 DEFINITIONS

A. MGB: Main Grounding Busbar

1.07 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Project Record Documents: Record actual locations of components and grounding electrodes.

1.08 QUALITY ASSURANCE

A. Conform to requirements of NFPA 0.

B. Comply with TIA/EIA-60 for telecommunications grounding.

1.0 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

1.10 ARRANTY

A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 0 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor si e is not indicated, si e to comply with NFPA 0 but not less than applicable minimum si e requirements specified.

E. Existing Grounding Electrode System:
   1. Extend and provide connection to required and supplemental grounding electrodes indicated to form a complete grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Existing Metal Underground Water Pipe(s :
      a. Provide connection to existing underground metal domestic and fire protection (where present water service pipe(s that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Existing Metal In-Ground Support Structure:
      a. Provide a new connection as required to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 0.
   4. Existing Ground Ring:
      a. Existing structure currently consists of an existing ground ring. Contractor shall locate and extend bare copper wire from main grounding busbar to existing ground ring and terminate for a complete grounded system.
   5. Ground Rod Electrode(s :
      a. Provide additional ground rods where indicate or required.
   6. Provide additional ground electrode(s as required to achieve specified grounding electrode system resistance.

. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 0. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

F. Service-Supplied System Grounding:
   1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded bus in service disconnect enclosure.
   2. For each service disconnect, provide main bonding jumper to connect neutral (grounded bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded conductors and ground on load side of service disconnect.

G. Grounding for Separate Building or Structure Supplied by Feeder(s or Branch Circuits:
   1. Provide grounding electrode system for each separate building or structure.
   2. Provide equipment grounding conductor routed with supply conductors.
   3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
   4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded conductors and ground.

H. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energi ed as indicated and in accordance with NFPA 0.
   2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
   3. Where circuit conductor si es are increased for voltage drop, increase si e of equipment grounding conductor proportionally in accordance with NFPA 0.
   4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
   5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded or isolated/insulated ground bus.
   6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 46 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1 Use bare copper conductors where installed underground in direct contact with earth.

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 46 .
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors or compression connectors for accessible connections.
      a. Exceptions:
         1 Use exothermic welded connections for connections to metal building frame.

D. Ground Bars:
   1. Description: Copper rectangular ground bars with mounting brackets and insulators.
   2. Si e: As indicated.
   3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:
   1. Comply with NEMA GR 1.
   2. Material: Copper-bonded (copper-clad steel.
   3. Si e: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

F. Ground Access Wells:
   1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
   2. Si e: As required to provide adequate access for testing and inspection, but not less than minimum si e requirements specified.
      a. Round Wells: Not less than 8 inches in diameter.
      b. Rectangular Wells: Not less than 12 by 12 inches.
   3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
   4. Cover: Factory-identified by permanent means with word "GROUND".
   5. Manufacturers:
      a. Advanced Lightning Technology (ALT : www.altfab.com/ sle.
      b. Erico International Corporation: www.erico.com/ sle.
      c. Harger Lightning Grounding: www.harger.com/ sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 CONDUCTORS IRE

A. Material: Copper.

B. Grounding electrode conductors and bonding jumpers:
   1. Bare stranded conductor.

C. Equipment grounding conductors:
   1. Stranded, insulated.

D. Si e conductors as indicated on the Drawings. If no si e is indicated, si e conductors to meet NFPA 0 requirements.

2.04 CONNECTORS AND ACCESSORIES

A. Compression Crimp Connectors: Copper.

B. Mechanical Connectors: Bron e.

C. Exothermic Connectors: Exothermic charges and molds as required for various configurations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify existing conditions prior to beginning work.

E. Verify final length and location of ground conductors.

F. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship .

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury hori ontally in trench at least 30 inches (50 mm deep in accordance with NFPA 0 or install at 45 degree angle or bury hori ontally in trench at least 30 inches (50 mm deep in accordance with NFPA 0.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

D. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 0553.

F. Install Products in accordance with manufacturer's instructions.

G. Refer to grounding details on Drawings.

H. Install ground electrodes at locations indicated or required. Install additional rod electrodes as required to achieve specified resistance to ground.

I. Install a 10 grounding conductor from the grounding electrode system to each telephone board.

. Provide bonding to meet requirements described in Quality Assurance.

. Equipment Grounding Conductor: Provide an equipment grounding conductor with each feeder and branch circuit regardless of raceway type. Terminate each end on suitable lug, bus, or bushing.

L. Concealed connections such as those underground or buried inside inaccessible wall or ceiling spaces shall be compression crimp or exothermic type. Mechanical connections shall be for exposed or readily accessible connections only.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

C. Perform inspection, testing, and adjusting in accordance with Section 01 4000.

D. Perform inspections and tests listed in NETA ATS, Section .13.

E. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

F. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION 26 0526

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SECTION 26 052
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

B. Conduit and equipment supports.

C. Anchors and fasteners.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for inc (Hot-Dip Galvani ed Coatings on Iron and Steel Products.

B. ASTM A153/A153M - Standard Specification for inc Coating (Hot-Dip on Iron and Steel Hardware.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of inc on Iron and Steel.

D. MFMA-4 - Metal Framing Standards Publication.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction.

F. NFPA 0 - National Electrical Code.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate si es and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.04 DESCRIPTION

A. Description: Steel channel, fittings, and anchors used to support various electrical devices and equipment racks.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 0.

B. Comply with applicable building code.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Materials and components shall be inspected for damage and physical defects.

B. Materials and components shall be stored in accordance with manufacturer's recommendations.

1.07 ARRANTY

A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and si es are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 0 and product listing.
   5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use inc-plated steel or approved equivalent unless otherwise indicated.
      b. Corrosive or Wet Indoor Locations: Use stainless steel or aluminum unless otherwise indicated.
      c. inc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvani ed Steel: Hot-dip galvani ed after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; stainless steel or aluminum.
   2. Conduit Clamps: 2-piece, bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut Framing Systems: Factory-fabricated continuous-slot metal channel (strut and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Comply with MFMA-4.
   2. Material:
      a. Indoor Dry Locations: Use inc-plated steel or galvani ed steel.
      b. Outdoor Locations: Use stainless steel or aluminum.
      c. Corrosive or Damp/Wet Indoor Locations: Use stainless steel or aluminum..

E. Hanger Rods: Threaded inc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
   4. Hollow Masonry: Use toggle bolts.
   5. Hollow Stud Walls: Use toggle bolts.
   6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
   . Sheet Metal: Use sheet metal screws.
   8. Wood: Use wood screws.

2.02 MANUFACTURERS

A. Thomas Betts Corporation

B. Threaded Rod Company

C. Unistrut.

D. Engineer approved equivalent.

2.03 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of si e and type as indicated on the Drawings, adequate to carry the loads of equipment and conduit, including weight of wire in conduit. Provide stainless steel materials in wet, damp, and corrosive areas.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship .

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Engineer, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Engineer, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut to support equipment as required.
   2. Use metal channel (strut secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. In wet and damp locations use stainless steel channel supports to stand cabinets, conduits, and panelboards ¼" off wall.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly si ed 3-1/2 high concrete pad constructed in accordance with Section 03 3000.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

. Install products in accordance with manufacturer's instructions.

. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.

L. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

M. Fabricate supports from stainless steel or aluminum channel in corrosive or wet/damp locations. Utili e structural steel or steel channel for dry interior locations only. Rigidly weld support members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

N. Install surface-mounted cabinets and panelboards with minimum of four anchors.

3.03 FIELD QUALITY ASSURANCE

A. Verify all supports are securely anchored and fastened.

B. Verify all supports are level and square.

END OF SECTION 26 052

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SECTION 26 0533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvani ed steel rigid metal conduit (RMC .
B. Stainless steel rigid metal conduit (RMC .
C. Aluminum rigid metal conduit (RMC .
D. Stainless steel intermediate metal conduit (IMC .
E. Flexible metal conduit (FMC .
F. Liquidtight flexible metal conduit (LFMC .
G. Rigid polyvinyl chloride (PVC conduit.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 0529 - Hangers and Supports for Electrical Systems.
C. Section 26 0533.16 - Boxes for Electrical Systems.
D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC .
B. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A .
C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction.
E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT .
F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit.
G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC .
H. NFPA 0 - National Electrical Code.
I. UL 1 - Flexible Metal Conduit.
. UL 6 - Electrical Rigid Metal Conduit-Steel.
. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel.
L. UL 514B - Conduit, Tubing, and Cable Fittings.
M. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
N. UL 1242 - Electrical Intermediate Metal Conduit-Steel.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum si es of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor si es increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.06 QUALITY ASSURANCE

A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.08 ARRANTY

A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 0, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvani ed steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use rigid PVC conduit.
   2. Exterior, Direct-Buried: Use rigid PVC conduit.
   3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.

D. Embedded Within Concrete:
   1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer : Use rigid PVC conduit.
   2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer : Use rigid PVC conduit.
   3. Within Concrete Walls Above Ground: Use rigid PVC conduit.
   4. Where rigid polyvinyl (PVC conduit is provided, transition to galvani ed steel rigid metal conduit (RMC , stainless steel rigid metal conduit (RMC , galvani ed steel intermediate metal conduit (IMC , stainless steel intermediate metal conduit (IMC , or galvani ed steel electrical metallic tubing (EMT where emerging from concrete.

E. Concealed Within Masonry Walls: Use galvani ed steel rigid metal conduit.

F. Interior, Damp or Wet Locations: Use aluminum rigid metal conduit.

G. Exposed, Interior: Use aluminum rigid metal conduit.

H. Exposed, Exterior: Use aluminum rigid metal conduit.

I. Corrosive Locations Above Ground: Use aluminum rigid metal conduit.

. Ha ardous (Classified Locations: Use aluminum rigid metal conduit.

. Flexible Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit (FMC .
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC .
   3. Maximum Length: 3 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 0.

B. Provide conduit, fittings, supports, and accessories required for complete raceway system.

C. Provide products listed, classified, and labeled as suitable for purpose intended.

D. Minimum Conduit Si e, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm trade si e.
   2. Underground, Exterior: 1-inch trade si e.

E. Where conduit si e is not indicated, si e to comply with NFPA 0 but not less than applicable minimum si e requirements specified.

2.03 GALVANI□ED STEEL RIGID METAL CONDUIT RMC

A. Manufacturers:
   1. Allied Tube Conduit, a division of Atkore International
   2. Nucor Tubular Products
   3. Western Tube, a division of ekelman Industries
   4. Engineer approved equivalent..

B. Description: NFPA 0, Type RMC galvani ed steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Nonha ardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 STAINLESS STEEL RIGID METAL CONDUIT RMC

A. Description: NFPA 0, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.

B. Fittings:
   1. Nonha ardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
   2. Material: Use stainless steel with corrosion resistance equivalent to conduit.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 STAINLESS STEEL INTERMEDIATE METAL CONDUIT IMC

A. Description: NFPA 0, Type IMC galvani ed steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Nonha ardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.

2.06 FLEXIBLE METAL CONDUIT FMC

A. Manufacturers:
   1. AFC Cable Systems, Inc; : www.afcweb.com/ sle.

2. Carol Cable
3. Electri-Flex Company
4. Engineer approved equivalent.

B. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.

C. Description: Interlocked steel construction.

D. Fittings: NEMA FB 1.

2.07 LIQUIDTIGHT FLEXIBLE METALLIC AND NONMETALLIC CONDUIT

A. Manufacturers:
1. AFC Cable Systems, Inc
2. Carol Cable.
3. Electri-Flex Company
4. Engineer approved equivalent.

B. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

C. Description: Interlocked aluminum construction with PVC jacket.

D. Fittings: NEMA FB 1.

2.08 GALVANI□ED STEEL ELECTRICAL METALLIC TUBING EMT

A. Manufacturers:
1. Allied Tube Conduit: www.alliedeg.com/ sle.
2. Beck Manufacturing, Inc: www.beckmfg.com.
3. Imperial Pipe Supply.
4. Triangle PWC.
5. Wheatland Tube Company: www.wheatland.com/ sle.
6. Engineer approved equivalent.

B. Description: NFPA 0, Type EMT galvani ed steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 9 .

C. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.

D. Description: ANSI C80.3; galvani ed tubing.

E. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

2.0 RIGID POLYVINYL CHLORIDE PVC CONDUIT

A. Manufacturers:
1. Carlon, a brand of Thomas Betts Corporation
2. AFC Cable Systems, Inc
3. Electri-Flex Company
4. Engineer approved equivalent.

B. Description: NFPA 0, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 ACCESSORIES

A. Conduit oint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

C. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

D. Sealing Compound for Ha ardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine conduit to verify that it is free from damage.

B. Examine conduit to verify it is free of foreign objects.

C. Verify that field measurements are as indicated.

D. Verify that mounting surfaces are ready to receive conduits.

E. Verify that conditions are satisfactory for installation prior to starting work.

F. Verify routing and termination locations of conduit prior to rough-in.

G. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Galvani ed Steel Rigid Metal Conduit (RMC : Install in accordance with NECA 101.

D. Intermediate Metal Conduit (IMC : Install in accordance with NECA 101.

E. Rigid Polyvinyl Chloride (PVC Conduit: Install in accordance with NECA 111.

F. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Process areas.
      b. Electrical rooms.
      c. Mechanical equipment rooms.
      d. Within joists in areas with no ceiling.
   4. Unless otherwise approved, do not route exposed conduits:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
   5. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   6. Arrange conduit to maintain adequate headroom, clearances, and access.
   . Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
   8. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   9. Maintain minimum clearance of 12 inches between conduits and hot surfaces.

10. Group parallel conduits in same area on common rack.

G. Conduit Support:
   1. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   2. Use conduit strap to support single surface-mounted conduit.
      a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
   3. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
   4. Use conduit clamp to support single conduit from beam clamp or threaded rod.
   5. Use trape e hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.

H. Connections and Terminations:
   1. Use approved inc-rich paint or conduit joint compound on field-cut threads of galvani ed steel conduits prior to making connections.
   2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
   3. Use suitable adapters where required to transition from one type of conduit to another.
   4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
   5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
   6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
   . Secure joints and connections to provide mechanical strength and electrical continuity.

I. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
   2. Make penetrations perpendicular to surfaces unless otherwise indicated.
   3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
   4. Conceal bends for conduit risers emerging above ground.
   5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
   6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimi e roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.

. Underground Installation:
   1. Provide trenching and backfilling; see Section 31 2316.13.
   2. Minimum Cover, Unless Otherwise Indicated or Required:
      a. Underground, Exterior: 42 inches.
   3. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 0553.

. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 0 for rigid polyvinyl chloride (PVC conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where conduits are subject to earth movement by settlement or frost.

L. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
   a. Where conduits pass from outdoors into conditioned interior spaces.
   b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

M. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

N. Provide grounding and bonding; see Section 26 0526.

O. Identify conduits; see Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvani ed finishes using inc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 26 0533.13

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SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and Device Boxes, Including Those Used as unction and Pull Boxes.

B. Cabinets and Enclosures, Including Those Used as unction and Pull Boxes.

C. Boxes for ha ardous (classified locations.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0533.13 - Conduit for Electrical Systems:

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum .

G. NFPA 0 - National Electrical Code.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

. UL 508A - Industrial Control Panels.

. UL 514A - Metallic Outlet Boxes.

L. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Ha ardous (Classified Locations.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 0.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum si es of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 0.
   4. Coordinate minimum si es of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 0.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   . Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, cabinets and enclosures, boxes for ha ardous (classified locations, and underground boxes/enclosures.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. eys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

A. Manufacturer: Company speciali ing in manufacturing Products specified in this Section with minimum three years documented experience.

B. Conform to requirements of NFPA 0.

C. Product Listing Organi ation Qualifications: An organi ation recogni ed by OSHA as a Nationally Recogni ed Testing Laboratory (NRTL and acceptable to authorities having jurisdiction.

D. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

1.08 ARRANTY

A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 0 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box si e is not indicated, si e to comply with NFPA 0 but not less than applicable minimum si e requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes, Including Those Used as unction and Pull Boxes:
   1. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   2. Use cast iron boxes where exposed galvani ed steel rigid metal conduit is used.
   3. Use cast aluminum boxes where aluminum rigid metal conduit is used.
   4. Use suitable concrete type boxes where flush-mounted in concrete.
   5. Use suitable masonry type boxes where flush-mounted in masonry walls.
   6. Use raised covers suitable for the type of wall construction and device configuration where required.
   . Use shallow boxes where required by the type of wall construction.
   8. Do not use "through-wall" boxes designed for access from both sides of wall.
   9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.

12. Minimum Box Si e, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets : 4 inch square by 1-1/2 inch deep (100 by 38 mm trade si e.
    b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm trade si e.
    c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm trade si e.

C. Cabinets and Enclosures, Including Those Used as unction and Pull Boxes:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 12, painted steel.
    b. Indoor Corrosive and Wet/Damp Locations: Type 4 , stainless steel.
    c. Outdoor Locations: Type 3R, painted steel..
3. unction and Pull Boxes:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    b. Include cable supports if any dimension of the box is greater than 48 inches.
    c. Boxes 6 square feet and Larger: Provide sectionali ed screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    b. Back Panels: Painted steel, removable.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

D. Boxes for Ha ardous (Classified Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Examine prints for locations of all outlets.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 0.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Flush-mount boxes in new walls and surface-mount boxes on existing walls.

F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

G. Box Locations:
1. Locate boxes in accessible locations.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.

6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches hori ontal separation unless otherwise indicated.
8. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
9. Locate junction and pull boxes in the following areas, unless otherwise indicated:
   a. Concealed above accessible suspended ceilings.
   b. Within joists in areas with no ceiling.
   c. Electrical rooms.
   d. Mechanical equipment rooms.

H. Box Supports:
   1. Secure and support boxes in accordance with NFPA 0 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support supported by threaded conduit connections in accordance with NFPA 0. Do not provide support from piping, ductwork, or other systems.

I. Install boxes plumb and level.

. Close unused box openings.

. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

L. Provide grounding and bonding in accordance with Section 26 0526.

M. Identify boxes in accordance with Section 26 0553.

N. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 0.

O. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 3 feet if required to accommodate intended purpose.

P. Maintain headroom and present neat mechanical appearance.

Q. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

R. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

S. Use stamped steel bridges to fasten flush mounting outlet box between studs.

T. Use adjustable steel channel fasteners for hung ceiling outlet box.

U. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

V. Use gang box where more than one device is mounted together. Do not use sectional box.

W. Use cast outlet box in exterior locations exposed to the weather, unfinished areas and wet locations.

. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.
   1. Provide pull boxes where indicated on drawings or required to facilitate the installation of the conduit and wire.
   2. Pull box construction, in general, shall be NEMA 1 unless noted otherwise on the drawings.
   3. Pull boxes shall be located in unfinished areas unless specifically permitted on the drawings.

3.03 AD USTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

3.04 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.05 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

3.06 INTERFACE ITH OTHER PRODUCTS

A. Coordinate installation of outlet box.

B. Coordinate locations and si es of required access doors.

C. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

END OF SECTION 26 0533.16

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SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Underground warning tape.

E. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 05 3 - Power System Studies: Arc flash ha ard warning labels.

1.03 REFERENCE STANDARDS

A. ANSI 535.2 - American National Standard for Environmental and Facility Safety Signs.

B. ANSI 535.4 - American National Standard for Product Safety Signs and Labels.

C. NFPA 0 - National Electrical Code.

D. NFPA 0E - Standard for Electrical Safety in the Workplace.

E. UL 969 - Marking and Labeling Systems.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 0.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    a. Motor Control Centers:
        1 Identify ampere rating.
        2 Identify voltage and phase.
        3 Identify MCC name.
        4 Identify power source and circuit number. Include location when not within sight of equipment.
        5 Use identification nameplate to identify main overcurrent protective device.
        6 Use identification nameplate to identify load(s served for each branch device. Do not identify spares and spaces.
    b. Panelboards:
        1 Identify ampere rating.
        2 Identify voltage and phase.
        3 Identify panelboard name.
        4 Identify power source and circuit number. Include location when not within sight of equipment.
        5 Use typewritten circuit directory to identify load(s served for panelboards with a door. Do not identify spares and spaces.
        6 For power panelboards without a door, use identification nameplate to identify load(s served for each branch device. Do not identify spares and spaces.
    c. Enclosed switches, circuit breakers, and motor controllers:
        1 Identify load(s served. Include location when not within sight of equipment.

2. Service Equipment:
   a. Use identification nameplate to identify each service disconnecting means.
3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 0 including but not limited to the following.
   a. Service equipment.
   b. Industrial control panels.
   c. Motor control centers.
4. Arc Flash Ha ard Warning Labels: Use warning labels to identify arc flash ha ards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energi ed.
   a. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Ha ard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 0E for minimum PPE requirements" or approved equivalent.
   b. Service Equipment: Include the following information in accordance with NFPA 0.
      1 Nominal system voltage.
      2 Available fault current.
      3 Clearing time of service overcurrent protective device(s .
      4 Date label applied.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

C. Identification for Raceways:
   1. Use underground warning tape to identify underground raceways.

D. Identification for Boxes:
   1. Use handwritten text using indelible marker to identify circuits enclosed.

E. Identification for Devices:
   1. Use identification label to identify serving branch circuit for all receptacles.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic nameplates suitable for exterior use.
   2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
      a. Color: White text on black background.
   3. Mounting Holes for Mechanical Fasteners: Two, centered on sides for si es up to 1 inch high; Four, located at corners for larger si es.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
      a. Use only for indoor locations.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
   1. Plastic Nameplates: Minimum Si e: 1 inch by 2.5 inches.

2. Identification Labels: 0.5 inch by 2.5 inches.
3. Legend:
   a. Equipment designation or other approved description.
4. Text: All capitali ed unless otherwise indicated.
5. Minimum Text Height:
   a. Equipment Designation: 3/8 inch.
6. Color:
   a. Normal Power System: White text on black background.

2.03 IRE AND CABLE MAR ERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitali ed unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

G. Description: split sleeve type wire markers.

H. Locations: Each conductor at motor control centers, control panels, panelboard gutters, pull boxes, and junction boxes at each load connection.

I. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
   2. Control Circuits: Control wire number indicated on shop drawings.

2.04 UNDERGROUND ARNING TAPE

A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:
   1. Tape for Buried Power Lines: Black text on red background.
   2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.05 ARNING SIGNS AND LABELS

A. Comply with ANSI 535.2 or ANSI 535.4 as applicable.

B. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Si e: by 10 inches unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recogni ed to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Si e: 2 by 4 inches unless otherwise indicated.

D. Description: 4 inch wide polyethylene tape, detectable type colored red with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 6 inch(es below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

C. Install nameplates and labels parallel to equipment lines.

END OF SECTION 26 0553

SECTION 26 0573
PO ER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash ha ard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Additional requirements for arc flash ha ard warning labels.

B. Section 26 2816.13 - Enclosed Circuit Breakers.

C. Section 26 2816.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

A. ANSI 535.4 - American National Standard for Product Safety Signs and Labels.

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants.

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Ha ard Calculations.

G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.

H. NFPA 0 - National Electrical Code.

I. NFPA 0E - Standard for Electrical Safety in the Workplace.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Existing Installations: Coordinate with equipment manufacturer(s to obtain data necessary for completion of studies.
   2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Engineer.
   3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash ha ard warning labels (where applicable .

1.05 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Study preparer's qualifications.

C. Field testing agency's qualifications.

D. Study reports, stamped or sealed and signed by study preparer.

E. Field quality control reports.

F. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

G. Project Record Documents: Revise studies as required to reflect as-built conditions.
   1. Include hard copies with operation and maintenance data submittals.
   2. Include computer software files used to prepare studies with file name(s cross-referenced to specific pieces of equipment and systems.

1.06 PO ER SYSTEM STUDIES

A. Scope of Studies:
   1. Perform analysis of new electrical distribution system.
   2. Except where study descriptions below indicate exclusions, analy e system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors .

B. General Study Requirements:
   1. Comply with NFPA 0.
   2. Perform studies utili ing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
   1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
      a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, /R ratio, and primary protective device information.
         1 Obtain up-to-date utility information from Owner.
      b. Motors: Include manufacturer/model, type (e.g. induction, synchronous , horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
      c. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and /R ratio.
      d. Protective Devices:
         1 Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip , frame si e, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. one selective interlocking .
      e. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
      f. Conductors: Include feeder si e, material (e.g. copper, aluminum , insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Short-Circuit Study:
   1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
   2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
      a. Maximum utility fault currents.
      b. Maximum motor contribution.
   3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:
   1. Comply with applicable portions of IEEE 242 and IEEE 399.

2. Analy e protective devices and associated settings for suitable margins between time-current curves to achieve full selective coordination while providing adequate protection for equipment and conductors.

F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 0E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 0E Annex D , where applicable.
   a. To clarify IEEE 1584 statement that "equipment below 240 V need not be considered unless it involves at least one 125 kVA or larger low-impedance transformer in its immediate power supply" for purposes of studies, study preparer to include equipment rated less than 240 V fed by transformers less than 125 kVA in calculations.
   b. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
   c. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 yielding conservative results.
3. Analy e alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
   a. Maximum and minimum utility fault currents.
   b. Maximum and minimum motor contribution.

G. Study Reports:
1. General Requirements:
   a. Identify date of study and study preparer.
   b. Identify study methodology and software product(s used.
   c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
   d. Identify base used for per unit values.
   e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
   f. Include conclusions and recommendations.
2. Short-Circuit Study:
   a. For each scenario, identify at each bus location:
      1 Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable .
      2 Fault point /R ratio.
      3 Associated equipment short circuit current ratings.
   b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
   a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
   b. For each graph include (where applicable :
      1 Partial single-line diagram identifying the portion of the system illustrated.
      2 Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
      3 Conductors: Damage curves.
      4 Transformers: Inrush points and damage curves.
      5 Motors: Full load current, starting curves, and damage curves.
   c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
      1 Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:
   a. For each scenario, identify at each bus location:
   b. For purposes of producing arc flash ha ard warning labels, summari e the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.
   c. Identify locations where the calculated maximum incident energy exceeds 40 calories per sq cm.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in State where project is located and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.
   1. Study preparer may be employed by the manufacturer of the electrical distribution equipment.
   2. Study preparer may be employed by field testing agency.

B. Field Testing Agency Qualifications: Independent testing organi ation speciali ing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utili ing specified methodologies.
   1. Acceptable Software Products:
      a. EasyPower LLC: www.easypower.com/ sle.
      b. ETAP/Operation Technology, Inc: www.etap.com/ sle.
      c. Power Analytics Corporation: www.poweranalytics.com/ sle.
      d. S M Systems Analysis, Inc: www.skm.com/ sle.

PART 2 PRODUCTS

2.01 ARC FLASH HA□ARD ARNING LABELS

A. Provide warning labels complying with ANSI 535.4 to identify arc flash ha ards for each work location analy ed by the arc flash and shock risk assessment.
   1. Materials: Comply with Section 26 0553.
   2. Minimum Si e: 4 by 6 inches.
   3. Legend: Provide custom legend in accordance with NFPA 0E based on equipment-specific data as determined by arc flash and shock risk assessment.
      a. Include orange header that reads "WARNING" where calculated incident energy is less than 40 calories per square cm.
      b. Include red header that reads "DANGER" where calculated incident energy is 40 calories per square cm or greater.
      c. Include the text "Arc Flash and Shock Ha ard; Appropriate PPE Required" or approved equivalent.
      d. Include the following information:
         1 Arc flash boundary.
         2 Available incident energy and corresponding working distance.
         3 Site-specific PPE (personnel protective equipment requirements.
         4 Nominal system voltage.
         5 Limited approach boundary.
         6 Restricted approach boundary.
           Equipment identification.
         8 Date calculations were performed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 0553.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting. All on-site work shall be performed by or directly supervised by a Level 3 or Level 4 NETA certified technician.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Adjust equipment and protective devices for compliance with studies and recommended settings.

E. Notify Engineer of any conflicts with or deviations from studies. Obtain direction before proceeding.

F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.03 CLOSEOUT ACTIVITIES

A. See Section 01 800 - Closeout Submittals, for closeout submittals.

END OF SECTION 26 0573

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SECTION 26 2100
LO -VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 0, and as designated by the Utility Company.

1.04 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R (NESC(R .

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NFPA 0 - National Electrical Code.

1.05 ADMINISTRATIVE REQUIREMENTS

A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.

B. Coordination:
   1. Verify the following with Utility Company representative:
      a. Utility Company requirements, including division of responsibility.
      b. Exact location and details of utility point of connection.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
   3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. Utility Company charges associated with providing permanent service to be paid by Owner.

E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:
   1. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.06 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.

D. Project Record Documents: Record actual locations of equipment and installed service routing.

1.07 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code .
   2. NFPA 0 (National Electrical Code .
   3. The requirements of the Utility Company.
   4. The requirements of the local authorities having jurisdiction.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics:
   1. Service Type: Overhead.
   2. Service Voltage: 240/120 V, 1 phase, 60 H .
   3. Service Si e: 100 A.

C. Utility Company: United Power.
   1. Point of Contact: Heidi lepper-Hummel.
   2. Address: 500 Cooperative Way, Brighton, CO 80603.
   3. Phone: 20-685-5661.

D. Division of Responsibility:
   1. Pole-Mounted Utility Transformers:
      a. Utility Poles: Furnished and installed by Utility Company.
      b. Transformers: Furnished and installed by Utility Company.
      c. Transformer Grounding Provisions: Furnished and installed by Utility Company.
      d. Primary: Furnished and installed by Utility Company.
      e. Secondary - Overhead Service:
         1 Conduits/Service Masts: Furnished and installed by Contractor.
         2 Conductors: Furnished and installed by Contractor.
   2. Terminations at Service Point: Provided by Utility Company.
   3. Metering Provisions: Metering furnished and installed by Utility Company.
      a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship .

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required protective bollards in accordance with Utility Company requirements.

E. Provide required support and attachment components in accordance with Section 26 0529.

F. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.

G. Identify service entrance equipment, including main service disconnect(s in accordance with Section 26 0553.

END OF SECTION 26 2100

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SECTION 26 2816.13
ENCLOSED CIRCUIT BREA ERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed main circuit breaker.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 3 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

A. FS W-C-3 5 - Circuit Breakers, Molded Case; Branch Circuit and Service.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum .

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.

E. NFPA 0 - National Electrical Code.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

I. UL 869A - Reference Standard for Service Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 0.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, ampacity, integrated short circuit ampere rating, and let through current for circuit breaker.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

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, installation, and starting of product.

E. Record actual locations of Products; indicate actual branch circuit arrangement.

F. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 0.

B. Maintain one copy of each document on site.

C. Manufacturer Qualifications: Company speciali ing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Metallic components shall be inspected for damage and physical defects.

B. Metallic components shall be stored in accordance with manufacturer's recommendations.

1.08 ARRANTY

A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Schneider Electric; Square D Products

B. Cutler-Hammer/Eaton Corporation.

C. Siemens Industry, Inc

D. Engineer approved equivalent.

2.02 ENCLOSED CIRCUIT BREA ERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
   1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 3.

E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

I. Provide externally operable handle with means for locking in the OFF position.

. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

2.03 MOLDED CASE CIRCUIT BREA ERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489and complying with FS W-C-3 5 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:

1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating as indicated by the results of the power system study.
2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

E. 600V rating. Provide circuit breaker with current rating as listed on the Drawings.

F. Provide circuit breaker with integral thermal and instantaneous magnetic trip in each pole.

2.04 ACCESSORIES

A. Enclosure: NEMA AB 1, Type 12.
   1. Fabricate enclosure from steel.
   2. Finish: Manufacturer's standard enamel finish, gray color.

B. Handle Lock: Include provisions for padlocking.

C. Provide insulated grounding lug.

D. Provide products suitable for use as service entrance equipment where so applied.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship .

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 0.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 9 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 3.

I. Height: 5 feet to operating handle.

. Provide engraved plastic nameplate on each enclosure to identify function or load served.

. Provide arc flash warning labels in accordance with NFPA 0.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section .6.1.1 for circuit breakers used for service entrance.

D. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

E. Perform field inspection and testing in accordance with Section 01 4000.

F. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.

3.03 AD USTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.04 SCHEDULE

A. See panelboard schedules, and electrical one-line diagram for individual circuit breaker and fuse requirements.

END OF SECTION 26 2816.13

SECTION 26 2816.16
ENCLOSED S ITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 3 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum .

C. NEMA AB 1 - Molded Case Circuit Breakers.

D. NEMA S 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum .

E. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.

F. NFPA 0 - National Electrical Code.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

H. UL 98 - Enclosed and Dead-Front Switches.

I. UL 869A - Reference Standard for Service Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 0.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 0.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect products from weather and moisture by covering with heavy plastic or canvas and by maintaining heating within enclosure in accordance with manufacturer's instructions.

1.0 ARRANTY

A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expenses.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Schneider Electric; Square D Products

B. Eaton Corporation

C. Siemens Industry, Inc

D. Engineer approved equivalent.

E. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.02 ENCLOSED SAFETY S ITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

M. Heavy Duty Switches:
   1. Comply with NEMA S 1.
   2. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
      a. Provide means for locking handle in the ON position where indicated.

N. Provide the following features and accessories where indicated or where required to complete installation:
   1. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship .

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 0.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 9 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Identify enclosed switches in accordance with Section 26 0553.

I. Install NEMA S 1 type disconnects using spacers to stand enclosure a minimum of 1/8" from wall or mounting surface.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Perform field inspection in accordance with Section 01 4000.

C. Perform inspections and tests listed in NETA ATS, Section .5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 AD USTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

END OF SECTION 26 2816.16

SECTION 26 2 23
VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable frequency drives (VFD in separate enclosures.

B. The Systems Integrator, specified in Section 25 1300 - Instrumentation and Control Integration, shall be responsible for supplying and commissioning the equipment specified in this section. Installation shall be by the Division 26 Contractor.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Housekeeping pads.

B. Section 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Variable-frequency drive cable.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0529 - Hangers and Supports for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 05 3 - Power System Studies: Additional criteria for selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code .

B. IEEE C5 .13 - IEEE Standard Requirements for Instrument Transformers.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum .

E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.

F. NEMA ICS 6 - Industrial Control and Systems: Enclosures.

G. NEMA ICS - Industrial Control and Systems: Adjustable-Speed Drives.

H. CSA Approved - CSA-C22 No. 14-M191.

I. IEC: 146A.

. IEEE Standard 444 (ANSI-C343 .

. IEEE - 519.

L. NEMA ICS .1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems.

M. NEMA ICS .2 - Application Guide for AC Adjustable Speed Drive Systems.

N. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems.

O. NEMA MG 1 - Motors and Generators.

P. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum .

Q. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.

R. NFPA 0 - National Electrical Code.

S. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

T. UL 508A - Industrial Control Panels.

U. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy (Ed. 2 .

V. UL - 508C.

1.04 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate wiring diagram, front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
   1. Include dimensioned plan and elevation views of controllers and adjacent equipment with required clearances indicated.
   2. Include wiring diagrams showing factory and field connections.

D. Derating Calculations: Indicate ratings adjusted for applicable service conditions.

E. Test Reports: Indicate field test and inspection procedures and test results.

F. 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.

G. Source quality control test reports.

H. Field quality control test reports.

I. Operation Data: NEMA ICS .1. Include instructions for starting and operating controllers, and describe operating limits that may result in ha ardous or unsafe conditions.

. Maintenance Data: NEMA ICS .1. Include routine preventive maintenance schedule.

. Predictive harmonic analysis - refer to requirements listed later in this Section.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 0.

B. Manufacturer Qualifications: Company speciali ing in manufacturing the products specified in this section with minimum ten years documented experience and with service facilities within 250 miles of Project.

C. VFD shall have a minimum MTBF (mean time between failure rating of 100,000 hours.

D. Power transistors, SCR's and diodes shall be tested to ensure correct function and highest reliability.

E. All printed circuit boards shall be tested at 50°C for 50 hours. The VFD manufacturer shall provide certification that the tests have been completed.

F. Every controller will be functionally tested with a motor to ensure that if the drive is started up according to the instruction manual provided, the unit will run properly.

G. The VFD systems shall be fabricated by the same VFD manufacturer, to assure a properly coordinated system. VFD systems must not be fabricated in whole or in part by parties other than the VFD manufacturer. Third-party distributor or packager modifications to a standard product will not be allowed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.07 ARRANTY

A. Full warranty against defects in materials and workmanship for two years after substantial completion, including all parts, labor, and expensses.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Variable-Frequency Motor Controllers:
   1. ABB: www.new.abb.com/ sle.
   2. Eaton Corporation: www.eaton.com/ sle.
   3. Schneider Electric: www.se.com/ sle.

B. Basis of Design: Eaton CP

C. Substitutions: See Section 01 6000 - Product Requirements.

D. Source Limitations: Provide variable-frequency motor controllers and associated components produced by single manufacturer and obtained from single supplier.

2.02 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Controller Assemblies: Comply with NEMA ICS , NEMA ICS .1, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

D. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA ICS .2, NEMA MG 1 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:
   1. Motor type (e.g., induction, reluctance, and permanent magnet ; consider NEMA MG 1 design letter or inverter duty rating for induction motors.
   2. Motor load type (e.g., constant torque, variable torque, and constant horsepower ; consider duty cycle, impact loads, and high inertia loads.
   3. Motor nameplate data.
   4. Requirements for speed control range, speed regulation, and braking.
   5. Motor suitability for bypass starting method, where applicable.

E. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

F. Operating Requirements:
   1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
   2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.
   3. Efficiency: Minimum of 96 percent at full speed and load.
   4. Input Displacement Power Factor: Minimum of 0.96 throughout speed and load range.
   5. Overload Rating:
      a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.
      b. Constant Torque Loads: Minimum of 150 percent of nominal for 60 seconds.

G. Power Conversion System: Microprocessor-based, pulse width modulation type consisting of rectifier/converter, DC bus/link, and inverter.
   1. Rectifier/Converter: Diode-based, 18-pulse type unless otherwise indicated.

H. Control System:
   1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.

2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
3. Control Functions:
   a. Control Method: Selectable vector and scalar/volts per hert unless otherwise indicated.
      1 Scalar/Volts per Hert Control: Provide IR compensation for improved low-speed torque.
      2 Vector Control: Provide selectable autotuning function.
   b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
   c. Selectable braking control; DC injection or flux braking.
   d. Adjustable minimum/maximum speed limits.
   e. Adjustable pulse width modulation switching carrier frequency.
   f. Adjustable motor slip compensation.
   g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
   h. Automatic response to loss of speed reference; Selectable to run motor at last known speed, run motor at designated speed, or stop motor.
   i. Selectable frequency-skipping; minimum of three independently adjustable bands.
   j. Automatic catching of rotating motor.
   k. Safety Interlock: Provide permissive run safety interlock capability where indicated or required; upon activation of designated input, stop and prevent operation of motor; operational in both drive and bypass modes where applicable.
   l. Damper/Valve Control: Provide damper/valve control capability where indicated or required; upon receiving motor start command, activate designated damper/valve output and delay motor start until activation of designated end switch input confirms damper/valve operation.
4. Status Indications:
   a. Motor run/stop status.
   b. Motor forward/reverse status.
   c. Local/remote control status.
   d. Output voltage.
   e. Output current.
   f. Output frequency.
   g. DC bus voltage.
   h. Motor speed.
   i. Instantaneous power.
   j. Elapsed run time.
5. Protective Functions/Alarm Indications:
   a. Overcurrent.
   b. Motor overload.
   c. Undervoltage.
   d. Overvoltage.
   e. Controller overtemperature.
   f. Input/output phase loss.
   g. Output short circuit protection.
   h. Output ground fault protection.
6. Inputs:
   a. Digital Input(s : Three.
   b. Analog Input(s : Two.
. Outputs:
   a. Analog Output(s : One.
   b. Relay Output(s : Two.

8. Communications: Compatible with connected systems. Provide accessories necessary for proper interface.
    a. Serial Communications: RS-485; support for Modbus RTU protocol.
    b. Ethernet Communications
    c. Remote Monitoring Capabilities:
        1 Motor run/stop status.
        2 Hand-off-auto status.
        3 Fault information.
        4 Discrete input/output status.
        5 Analog input/output values.
    d. Remote Control Capabilities:
        1 Motor run/stop command.
        2 Hand-off-auto selection.
        3 Speed adjustment.
        4 Fault reset.
9. Features:
    a. Password-protected security access.
    b. Event log.

I. Power Conditioning/Filtering:
1. Provide DC link choke and input/line reactor for each controller unless otherwise indicated or required.
2. Provide input surge protection.
3. Provide where indicated:
    a. Input/line reactor.
    b. Output dV/dt filter.
    c. Output sine wave filter.
4. Reactor Impedance: 5 percent, unless otherwise indicated or required.

. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.
1. Disconnects: Circuit breaker type.
    a. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
    b. Provide auxiliary interlock for disconnection of external control power sources where applicable.
2. Provide door-mounted remote operator interface.
3. Pilot Devices Required:
    a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings, except where equivalent function is provided by remote operator interface.

. Service Conditions:
1. Provide controllers and associated components suitable for operation under following service conditions without derating:
    a. Altitude: Less than 6,600 feet.
    b. Ambient Temperature: Between 32 degrees F and 104 degrees F.

L. Short Circuit Current Rating:
1. Provide controllers with listed short circuit current rating not less than available fault current at installed location as determined by short circuit study performed in accordance with Section 26 05 3.
2. Provide line/input reactors where specified by manufacturer for required short circuit current rating.
3. Listed series ratings are not acceptable.

M. Conductor Terminations: Suitable for use with conductors to be installed.

N. Enclosures:
   1. Comply with NEMA ICS 6.
   2. NEMA 250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
   3. Finish: Manufacturer's standard unless otherwise indicated.
   4. Cooling: Forced air or natural convection as determined by manufacturer.

O. Instrument Transformers:
   1. Comply with IEEE C5 .13.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Connect secondaries to shorting terminal blocks.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:
   1. Molded Case Circuit Breakers:
      a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated or as required.
      b. Interrupting Capacity:
         1 Provide circuit breakers with interrupting capacity as required to provide short circuit current rating indicated, but not less than specified minimum requirements.
         2 Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than short circuit current rating indicated.

2.04 ACCESSORIES

A. Auxiliary Contacts:
   1. Comply with NEMA ICS 5.
   2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in circuit and interlocking.

B. Pilot Devices:
   1. Comply with NEMA ICS 5; heavy-duty type.
   2. Pushbuttons: Unless otherwise indicated, provide momentary, nonilluminated type with flush button operator; normally open or normally closed as indicated or as required.
   3. Selector Switches: Unless otherwise indicated, provide maintained, nonilluminated type with knob operator; number of switch positions as indicated or as required.
   4. Indicating Lights: Push-to-test type unless otherwise indicated.
   5. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:
   1. Comply with NEMA ICS 5.
   2. Provide number and type of relays indicated or required to perform necessary functions.
   3. Timing Relays: Electronic.

D. Control Power Transformers:
   1. Si e to accommodate burden of contactor coil(s and connected auxiliary devices, plus 500 VA spare capacity.
   2. Include primary and secondary fuses.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings of controllers are consistent with indicated requirements.

C. Verify that mounting surfaces are ready to accept controllers.

D. Verify that conditions are satisfactory for installation prior to starting work.

E. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install controllers in accordance with NECA 1 (general workmanship .

C. Install in accordance with NEMA ICS .1 and manufacturer's instructions.

D. Do not exceed manufacturer's recommended maximum cable length between controller and motor.

E. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 0.

F. Provide required support and attachment in accordance with Section 26 0529.

G. Install controllers plumb and level.

H. Unless otherwise indicated, mount floor-mounted controllers on properly si ed 3 inch high concrete pad constructed in accordance with Section 03 3000.

I. Provide grounding and bonding in accordance with Section 26 0526.

. Install field-installed devices, components, and accessories.

. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

L. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

M. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 05 3.

N. Provide required support and attachment in accordance with Section 26 0529.

O. Tighten accessible connections and mechanical fasteners after placing controller.

P. Identify controllers in accordance with Section 26 0553.

Q. Provide engraved plastic nameplates; minimum 1/2" lettering, identifying load served.

R. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Provide services of manufacturer's authori ed representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. Perform field inspection and testing in accordance with Section 01 4000.

D. Inspect and test in accordance with NETA ATS, except Section 4.

E. Test for proper interface with other systems.

F. Correct deficiencies and replace damaged or defective controllers or associated components.

G. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

H. The drive supplier shall hire a third party power quality evaluator to test voltage and current harmonics at the main bus of the 480 volt main lugs to determine compliance with the voltage and current harmonics requirements of the latest version of IEEE 519. The VFD shall comply with IEEE 519 voltage and current harmonics requirements. Supplementary forms of harmonic attenuation (such as inductors, capacitors, reactors or isolation transformers will only be allowed after proof that the initial forms of harmonics attenuation are performing properly. Any supplementary devices required for compliance with IEEE 519 shall be at no additional cost to the Owner.

I. Any problems found to be attributable to VFD induced harmonics or transients shall be corrected by the VFD supplier at no additional cost to the Owner. Problems may include, but are not limited to, the following:
   1. Neutral currents/Heating.
   2. Transformer heating/Noise.
   3. Digital communications interference.

3.04 MANUFACTURER S FIELD SERVICES

A. Provide the service of the manufacturer's field representative to prepare and start controllers.

B. Provide one eight hour day (not including travel time of operator training.

3.05 AD USTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.06 CLEANING

A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 800 - Closeout Submittals for closeout submittals.

B. See Section 01 900 - Demonstration and Training for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of controllers and associated devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's authori ed representative.
   4. Location: At project site.

END OF SECTION 26 2 23

SECTION 31 1000
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.

D. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:
   1. Vegetation removal limits.
   2. Areas for temporary construction and field offices.
   3. Areas for temporary or permanent placement of removed materials.

1.04 QUALITY ASSURANCE

A. Clearing Firm: Company speciali ing in the type of work required.
   1. Minimum of 3 years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

PART 3 EXECUTION

3.01 SITE CLEARING

A. Comply with other requirements specified in Section 01 000.

B. Minimi e production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
   1. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other work on the site.
   2. Provide hoses and water connections for moisture purposes.

C. Maintain haul routes for disposal of material clean and free from debris.

D. Protection:
   1. Protect bench marks, survey control points, and existing structures from damage or displacement.
   2. Protect all streets, curbs, and sidewalks not scheduled for demolition.
   3. Protect existing buildings and other structures to remain. Demolish paving over underground vaults to remain in a manner that does not damage the vault.
   4. In the event of damage to objects to remain, immediately make all repairs and replacements necessary to the approval of the Engineer, at no additional cost to the Owner.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

A. Protect existing trees, plants, landscaping materials, appurtenances, structures, and utilities that are not to be demolished and/or abandoned.
   1. Contractor shall repair or replace such damaged trees without additional compensation.

B. Do not remove or damage vegetation beyond the limits indicated on drawings.

C. Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain:
   1. At vegetation removal limits.

D. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

E. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
   1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
   2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
   3. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.

F. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.04 DISPOSAL

A. Owner has first right of refusal of salvaged manhole sections, castings, culverts, seal coat, and other salvageable items removed from public right-of-way.
   1. Notify Owner 5 days prior to salvage or demolition work to determine the disposition of items to be removed. Owners representative will mark items to be salvaged. Items shall be properly disconnected, removed from foundations, and stored at a location acceptable to the Owner.

B. Remove from project site and dispose of vegetation, rubbish, building materials, concrete, asphalt, culverts, fences, and other non-salvageable materials.

C. Excess material which is not desirable to be incorporated in this project such as vegetation, existing surfacing, broken concrete, etc., shall be disposed of at a disposal site provided by the Contractor. No payment for disposal of excess material or overhaul will be made but shall be considered incidental to the various other work on the project.

3.05 HAUL ROUTES

A. Determine haul roads with approval of agency having jurisdiction over proposed roadway.

B. Make condition survey of haul roads prior to use and document with necessary photographs and written descriptions.

C. eep dirt, dust, mud, and other debris reasonably free from construction operations.

D. Clean as needed to prevent muddy or dusty conditions.

E. Repair any damaged haul routes to match existing conditions before use.

3.06 DEBRIS

A. Remove debris, junk, and trash from site.

B. Do not burn or bury materials on site.

C. Maintain public streets, alleys, or other thoroughfares, used in carrying out disposal, free of litter or soil attributal to this operation. Equip and load trucks or other vehicles to prevent leakage, blowing off, or other escape of any portion of whatsoever. The cost being incurred by Owner in cleaning such litter will be charged to Contractor and deducted from monies due or to become due it under this contract.

D. Leave site in clean condition, ready for subsequent work.

E. Clean up spillage and wind-blown debris from public and private lands.

F. Storage of materials to be removed and disposed of will not be permitted to accumulate on site. Promptly remove all demolition materials.

END OF SECTION 31 1000

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SECTION 31 2316.13
TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation classification of materials, backfill and bedding materials, excavation for trenches, structures, and appurtenances, rock and rubble excavating, sheeting, shoring, and bracing, dewatering, backfill for structures and trenches, utility crossings and standard trench section requirements.

1.02 REFERENCE STANDARDS

A. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3 .

B. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth ; 2005.

C. Iowa Department of Transportation "Standard Specifications for Highway and Bridge Construction," latest edition and current supplements thereto.

1.03 STANDARD DETAILS

A. Typical detail drawings for trenching, backfilling, and compacting are provided herein or in the Drawings.

1.04 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Schedule work to avoid property owner inconvenience insofar as practicable during construction.

B. Existing Utilities:
   1. Before starting operations in any area in the vicinity of utility facilities, notify each utility of any operation which may affect their facilities. Provide notice to each utility sufficiently in advance of such operations to allow the utility time to mark the location of, relocate, adjust, or otherwise protect their facilities. Reach an agreement with each utility on appropriate action necessary to protect or relocate the utility facilities. The cost of such action to protect the facilities, except for locates, be borne by the Contractor. Utili e One-Call System (Iowa: 1-800-292-8989 , for locates for those utilities which subscribe to this service. Contact all other utilities that do not subscribe to the One-Call System.
   2. At all times conduct operation so that necessary clearances are maintained and said utility facilities are protected. Comply with all Local, State, and Federal, or other regulations in performing work near utility facilities.
   3. Should the Contractor damage any of the utility facilities during Contractor's operations or determine the work cannot be performed safely. Immediately notify the utility involved and cease work until arrangements are made to prevent further damage or a serious accident.
   4. Failure of the Contractor to provide timely notice to the utility or to conduct operations in such a manner that proper clearances are maintained and the utility facilities are protected at all times will be grounds for the issuance of a Stop Work Order.
   5. Notify Engineer of unexpected subsurface conditions and discontinue Work in area until Engineer provides notification to resume work.

C. Trees, Hedges and Shrubbery:
   1. Minimi e damage caused by construction operations. Exercise care in operating equipment beneath or adjacent to trees to prevent damage.
   2. Trim and repair trees, hedges, and shrubbery damaged by construction operations; remove broken branches.
   3. Cut no tree roots larger than 3" diameter (5mm .
   4. Notify Engineer prior to removing trees larger than 2" (50 mm diameter; and hedges and shrubbery.

5. Dispose of all items to an off-site location obtained by Contractor.

D. Verify that survey bench marks and intended elevations for the Work are as indicated.

E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

F. Remove, replace and repair fences, signs and other obstructions as necessary for construction; return all items to equal or better than original condition.

G. Restore obstructions removed to accommodate construction equipment or to facilitate excavation.

H. Contractor responsible for providing adequate barricades and protection around excavation and work areas.

I. Contractor responsible for providing and removing adequate temporary fencing for any fences that are disturbed by construction operations.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Select Backfill: Select backfill and bedding for pipes and structures shall be approved select material obtained from site or from off-site borrow areas. Material to be free of foreign substance, debris, large stones, rocks (1-1/2", 38 mm. , roots, organic or fro en material, expansive material and other deleterious materials. See details on Drawings and/or Typical Detail drawings herein for typical extent of select bedding and backfill.

B. Topsoil: Fill upper portion of trench in grass areas with six (6 inches minimum of topsoil.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 TRENCHING

A. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Trench Bottom:
1. Provide firm, stable and uniform support for full length of pipe.
2. With acceptable soils, lay pipe on layer of loose material after leveling trench bottom. If no loose material remains, shave soft material from trench walls and compact or use granular bedding.
3. If trench bottom is rocky or hard, over-excavate trench and place select or granular backfill below pipe as shown on the Typical "Pipe Cushion" Detail. Cushion material shall be the same as the specified bedding material.
4. When unstable material is encountered which may not provide a suitable foundation for pipe, remove unsuitable material and replace with stabili ing material.

C. eep sides of trench as nearly vertical as practicable within the limits of excavation codes and safety requirements; maintain vertical walls of excavation below top of pipe. Provide trench wall support as needed.

D. Excavate to full depth by machine; level trench bottom to provide uniform bearing and support for full length of pipe.

E. Provide bell holes at each pipe joint; allow access completely around circumference of pipe for proper jointing operations.

F. Conform to best trench bottom construction practices as recommended by pipe manufacturer.

G. Trench bottoms carried below required grade; backfill to proper elevation with granular bedding at no expense to the Owner.

H. When unstable material is encountered which may not provide a suitable foundation for pipe
1. Notify Engineer immediately.
2. Engineer will investigate questionable material to determine its suitability for pipe foundation.

3. If material is considered unsuitable for pipe foundations, Engineer will specify and authori e remedial measures in writing.
4. If removal of unsuitable material is authori ed:
   a. Replace with trench stabili ing material.
   b. Provide minimum of 4 inch of bedding material on top of stabili ing material to prevent point load. Bedding material graded sufficiently coarse to prevent movement and loss of bedding into trench stabili ing material.

I. Cut trenches wide enough to allow inspection of installed utilities. Maximum trench width shall be pipe O.D. plus 24". Provide cradling or strengthening at Contractor's expense if maximum trench width is exceeded.

. When the material being excavated is such that it is physically impossible to stabili e the trench bottom or secure a uniform bearing using dewatering and stabili ing material and in the judgement of the Engineer concrete encasement, concrete cradling or pilings are necessary to support the pipe, provide such support when directed in writing by the Engineer. If not shown on Drawings, cradling, encasing, and pilings, if necessitated by native trench conditions and not the Contractor's operations, shall be paid for as extra work.

. Hand trim excavations:
1. Under and around utilities.
2. Where overhead clearance prevents use of machine.
3. Under trees and shrubs where shown on Drawings.

L. Remove excavated material that is unsuitable for backfill from site. Waste at disposal area obtained by the Contractor at no cost to the Owner.

M. Remove excess excavated material from site.

N. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Engineer. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

O. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Engineer.

P. Remove brush, rubbish, spoil and material not suitable for backfill; waste at off-site disposal area obtained by the Contractor at no cost to the Owner.
1. Remove waste material promptly as it is generated by construction operations; do not permit it to accumulate.
2. Grade disposal areas periodically to reasonable neat surface to provide for drainage and access by others.

Q. Excavate in open cut the existing roads, utilities, and structures except as noted on Drawings.

3.03 DE ATERING

A. Do all work in dry conditions; obtain Engineer's approval of proposed methods of dewatering. See Section 31 2319.

3.04 EXISTING UTILITY CROSSINGS

A. Notify utility companies before excavating; utili e (; conform to current utility notification requirements.

B. Where new construction crosses or closely parallels existing utilities or utility services, excavate in advance of pipe laying to determine location and crossing arrangement, including exact construction line and grade.

C. Utility mains shown on Drawings in conflict with new facilities: Perform relocation or make arrangements with utility to perform Work at no additional cost to Owner

D. Utility mains not shown on Drawings in conflict with new facility: Notify Engineer immediately.

E. Provide compacted sand or granular material under all existing utilities or service lines that are located above the new pipeline. Compact material to a minimum of 95 Standard Proctor Density.

F. Repair any drainage tile interrupted during the course of construction according to details on Drawings and/or Typical Detail Drawings.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing uniformly throughout the placing of the compacted fill in accordance with ASTM D2922 and ASTM D698 to maintain quality control at all times.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

3.06 CLEANING

A. Clean up each portion of construction as it is completed.
   1. Restore obstructions removed to accommodate construction equipment or to facilitate excavation.
   2. Clean up and remove rubbish, debris, and surplus materials.

B. Reopen to traffic as soon as practicable.

C. Leave unused materials in a neat, compact stockpile.

D. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

E. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 31 2316.13

SECTION 31 2316
EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, slabs-on-grade, paving, and site structures.

B. Trenching for utilities outside the building to utility main connections.

C. Temporary excavation support and protection systems.

1.02 RELATED REQUIREMENTS

A. Document CS19 51-125: Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 01 5 13 - Temporary Erosion and Sediment Control: Slope protection and erosion control.

C. Section 01 000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring. General requirements for dewatering of excavations and water control.

D. Section 23 0553 - Identification for HVAC Piping and Equipment: Underground warning tapes at underground HVAC lines.

E. Section 26 0553 - Identification for Electrical Systems: Underground warning tapes at underground electrical lines.

F. Section 31 1000 - SITE CLEARING: Vegetation and existing debris removal.

G. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

H. Section 31 2323 - Fill: Fill materials, backfilling, and compacting.

1.03 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Temporary Support and Excavation Protection Plan.

C. Project Record Documents: Record drawings at project closeout according to 01 000 - Execution and Closeout Requirements. Show locations of installed support materials left in place, including referenced locations and depths, on drawings.

D. Shoring Installer's Qualification Statement.

E. Field Quality Control Submittals: Document visual inspection of load-bearing excavated surfaces.

1.04 QUALITY ASSURANCE

A. Temporary Support and Excavation Protection Plan:
   1. Indicate sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property.
   2. Include drawings and calculations for bracing and shoring.
   3. Bracing and shoring design to meet requirements of OSHA’s Excavation Standard, 29 CFR 1926, Subpart P.

B. Designer Qualifications: For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Colorado.

1.05 CLASSIFICATION OF MATERIALS

A. Earth: All material not classified as rock or rubble, includes: clay, silt, sand, gravel, hardpan, disintegrated shale and rock debris, junk, brick, loose stones, and boulders less than 1/3 cubic yards in volume.

B. Rock: Buried boulders larger than 1/3 cubic yards in volume or materials so hard and dense that continuous loosening by pneumatic tools or blasting is required for removal.

C. Rubble: Buried concrete foundations, beams, walls, and other materials which require continuous use of pneumatic tools or blasting.

D. Topsoil: Upper portion of soil profile containing a good supply of humus and a high degree of fertility. Topsoil is free of rocks, clods and other debris larger than 2" in diameter.

PART 3 EXECUTION

2.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

B. Determine the prevailing groundwater level prior to excavation. Proposed excavation extends more than 1 foot into the prevailing groundwater, control groundwater intrusion with a comprehensive dewatering procedures, or as directed by Geotechnical Engineer.

2.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities that remain and protect from damage.

C. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Engineer.

D. Use special care when excavating under and around existing facilities. Support existing facilities and earth under facilities to prevent settlement resulting from construction operations.

2.03 TEMPORARY EXCAVATION SUPPORT AND PROTECTION

A. Excavation Safety: Comply with OSHA's Excavation Standard, 29 CFR 1926, Subpart P.
   1. Excavations in stable rock or in less than 5 feet in depth in ground judged as having no cave-in potential do not require excavation support and protection systems.
   2. Depending upon excavation depth, time that excavation is open, soil classification, configuration and slope of excavation sidewalls, design and provide an excavation support and protection system that meets the requirements of 29 CFR 1926, Subpart P:
      a. Sloping and benching systems.
      b. Support systems, shield systems, and other protective systems.

2.04 EXCAVATING - GENERAL

A. Fill and consolidate to finished grade as directed by Engineer all holes resulting from operations of the Contractor, including removal of posts, utility poles. Fill voids as soon as practical, preferably the day created and not later than the following day. Restore a portion of the right-of-way or project limits disturbed by any such operations to an acceptable condition. Operation considered incidental to other bid items in project.

B. Backfill all excavations within 10' of the traveled way to within 8" from the top of the roadway surface, during non-working hours.

C. Apply necessary moisture to the construction area and haul roads to prevent the spread of dust. Following excavation and grading on this project the Contractor shall be responsible for disposing of excess material off the project.

D. Excavation and grading shall also include all the grading necessary to slope and shape the parking areas between the back of curb and to the final desired cross-section. This means that the Contractor shall be responsible under this contract to complete all work necessary to finish grade for the right-of-way area adjacent to the paving and not just an area back of the curb on each side. This work shall be considered incidental to the Project.

E. In the event any unsuitable bearing material is encountered at design depth, this condition shall be called to the attention of the Owner, or his representative, by the Contractor and a determination will be made prior to continuance. In the event over-excavation and special backfill are required, the Contractor shall proceed as instructed by the Engineer. If unsuitable bearing subgrade conditions were caused by the Contractor's operations at the site, then the cost of reestablishing suitable bearing conditions shall be at the expense of the Contractor and as directed by the Engineer. If unsuitable bearing conditions are a natural occurrence the extra cost shall be paid by the Owner.

F. Strip grass and vegetation from entire construction area and dispose of at landfill or location obtained by the Contractor.

G. Remove topsoil to minimum depth of eight inches (8" and stockpile for reuse to finish earth surfaces. In rural crop land areas, remove topsoil to a minimum depth of twelve inches (12" and stockpile for replacement on top of trench.

H. Provide temporary drainage facilities to prevent damage when necessary to interrupt natural drainage or flow of artificial drains.

I. Use special care when excavating under and around existing facilities and structures. Prevent settlement of existing structures which may result from construction operation.

. Excavate to accommodate new structures and construction operations.

. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

L. Do not interfere with 45 degree bearing splay of foundations.

M. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume.

N. Provide temporary means and methods, as required, to remove all water from excavations until directed by Engineer. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

2.05 SUBGRADE PREPARATION

A. See Section 31 2323 for subgrade preparation at general excavations.

2.06 FILLING AND BAC FILLING

A. Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation.

B. Install underground warning tape at buried utilities according to Sections 22 0553 and 26 0553.

C. See Section 31 2323 for fill, backfill, and compaction requirements at general excavations.

2.07 EXCAVATION - TOPSOIL

A. Excavate topsoil from areas to be further excavated or re-graded.

B. Stockpile in area designated on site. Remove excess topsoil not being reused from site.

C. Do not excavate wet topsoil.

D. Stockpile to topsoil depth not exceeding 8 feet.

2.08 EXCAVATION - SUBSOIL

A. Excavate subsoil from areas to be further excavated or re-graded.

B. Stockpile in area designated on site. Remove excess subsoil not being reused from site.

C. Do not excavate wet subsoil.

D. Stockpile subsoil to depth not exceeding 8 feet.

2.0 SHEETING, SHORING, AND BRACING

A. Considered incidental to project.

B. Contractor is solely responsible for complying with OSHA and all other governmental regulations.

C. Construct sheeting, shoring, and bracing required to hold walls of excavation and to provide safety for workers, to protect existing utilities and structures, and to permit dry conditions for construction.
   1. Sheeting: wood or steel.
   2. Construct and maintain sheeting and shoring in accordance with OSHA and all other governmental regulations. Contractor solely responsible for complying with the regulations.

D. Leave in place wood sheeting driven below level of pipe. Remove upper part of wood sheeting to a level 5'-0" (2 m below finish grade.

E. Pull steel sheeting except where indicated on Drawings.

F. When movable trench shield is used below spring line of pipe, lift shield prior to any forward movement to avoid pipe displacement. Fill void left by removal of shield, between consolidated fill and stable trench wall, with consolidated fill of the same type placed adjacent to the pipe.

2.10 EMBAN MENT CONSTRUCTION

A. Prepare site, place, and compact excavated materials to required elevation and cross section.

B. Scarify, disc, and roll foundation areas as necessary to provide proper bond with first layer of new fill.

C. If soft or yielding materials are encountered, remove unstable materials and replace with suitable materials and compact.

D. Place no roots, brush, grass, or other organic material in embankment; place no material on embankment when material or foundation is fro en.

E. Step or bench all existing slopes greater than five (5 hori ontal to one (1 vertical to connect existing grade with new fill.

F. Select material for each portion of embankment with approval of Engineer; select materials to avoid sharp change in texture.

G. Use fill material free of lenses, pockets, streaks or layers, or materials differing from surrounding materials.

H. Construct embankment in hori ontal layers not more than eight inches (8" in loose thickness.

I. Deposit each layer over full width of embankment as separate and distinct operation.

. After layer is deposited, smooth to uniform depth by means of suitable motor patrol or bulldo er.

. Compact selected materials in hori ontal layers with tamping or sheepsfoot roller; use roller designed to provide at least two hundred pounds per square inch (200 psi distributed on one (1 row of knobs; tamping feet must project not less than six and one-half inches (6-1/2" from face of drum.

L. Compact layer by rolling with tamping type roller until full weight of roller is supported by tamping feet, but with not less than one (1 pass per inch of loose thickness of layer.

M. Roller will be considered to be supported entirely on its tamping feet when feet do not penetrate more than three inches (3" into material being compacted.

N. If soil is wet so that it will not sufficiently compact by one (1 passage of roller per inch of loose thickness, provide minimum of one discing per two inches (2" of loose thickness.
   1. Cut and stir full depth of layer.
   2. Allow interval of not longer than two (2 hours between successive discings, or as directed by Engineer.
   3. After discing is completed, compact layer by specified rolling.

O. If soil is dry so that it will not satisfactorily compact by rolling, moisten material before compaction; manipulate material to secure proper distribution of moisture before compaction.

P. Place fill and compact on all sides of structures to same level as fill operation progresses to protect structures against displacement or other damage.

Q. Areas adjacent to structures which cannot be tamped with rollers: hand tamp with mechanical tamper to same degree of compaction as specified for other parts of embankment.

2.11 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Provide for visual inspection of load-bearing excavated surfaces by Geotechnical Engineer before placement of foundations.

2.12 CLEANING

A. Stockpile excavated material to be re-used in area designated on site.

B. Remove excavated material that is unsuitable for re-use from site.

C. Remove excess excavated material from site.

2.13 PROTECTION

A. Divert surface flow from rains or water discharges from the excavation.

B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

C. Protect open excavations from rainfall, runoff, free ing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.

D. Protect bottom of excavations and soil adjacent to and beneath foundation from free ing.

E. eep excavations free of standing water and completely free of water during concrete placement.

END OF SECTION 31 2316

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SECTION 31 231
DE ATERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. All labor, materials, and equipment necessary to dewater all excavations and trenches in accordance with the requirements of the Contract Documents.

1.02 REGULATORY REQUIREMENTS

A. Conform with all city, county, state, and federal requirements and obtain permits for the control and discharge of water from dewatering operations.

B. Coordinate with Owner, other Contractors, Sub-contractors and governmental bodies.

C. Secure all necessary permits to complete the requirements of this Section.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Prior to excavation, submit a detailed plan, operation and removal schedule for dewatering. Contractor may be required to demonstrate the system and to verify that adequate equipment, personnel, and materials are provided to dewater the excavations and trenches at all locations.

1. Submit the dewatering plan for Owner and Engineer's record. Engineer's review not required.

1.04 QUALITY ASSURANCE

A. Contractor is responsible for controlling discharge rate and effect of the dewatering system.

B. Establish, observe, and record reference points at frequent intervals to detect any settlement of structures and roads adjacent to areas of proposed dewatering. The Contractor is responsible for protecting adjacent structures and roads. Any costs associated with the repair, restoration, or replacement of damaged structures and/or roads shall be the responsibility of the Contractor.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Dewatering may include, but not limited to, wells, well points, sumps, temporary pipelines for water disposal, rock or gravel placement, or any combination. Maintain standby pumping equipment on the job site.

PART 3 EXECUTION

3.01 GENERAL

A. Provide and remove all equipment necessary for dewatering. Provide dewatering systems with sufficient pumping equipment and machinery in good working condition and provide at all times, competent workmen for the operation of the systems. eep adequate standby equipment available at all times to insure continuous and efficient dewatering and maintenance of dewatering operation.

B. Maintain groundwater at least two feet below the bottom of any excavation or trench until entire structure is completed, backfilled, and building drainage system is operational. This includes any sump pumps or storm drains used as an outlet.

C. Commence dewatering for structures and pipelines when groundwater is first encountered, and dewater continuously until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.

D. Provide drainage for the site grading at all times. Divert surface runoff from excavations and trenches. Collect surface runoff in shallow ditches around the perimeter, drain to sumps, and pump or drain by gravity to maintain a bottom free from standing water.

E. Preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation by dewatering.

F. Excavate affected areas and replace with crushed rock, at no additional cost to the Owner, if foundation soils or bedrock are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water.

G. Provide a clean coarse granular working mat as required to provide a stable working base for construction equipment and to facilitate construction. Any other granular material needed for drainage shall be in addition to the working base provided.

H. Prevent flotation by maintaining a positive and continuous removal of water. Contractor is responsible and liable for all damages which may result from failure to adequately keep excavations and trenches dewatered.

I. Adequately space well points or wells to provide the necessary dewatering. Sand-pack or by other means to prevent pumping of fine sands or silts from the subsurface. Continuously check to ensure that the subsurface soil is not being removed by the dewatering operation.

. Dispose of water in a suitable manner without damage to adjacent property. Do not drain water into Work built or under construction. Filter water using an approved method to remove sand and fine-si ed soil particles before disposal into any drainage system.

. Release groundwater to its static level in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures or pipelines.

L. Provide groundwater monitoring wells as necessary.

END OF SECTION 31 231

SECTION 31 2323
FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade, footings, slabs-on-grade, paving, site structures, and utilities within the building.

B. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

A. Document CS19 51-125: Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 31 2316 - Excavation: Removal and handling of soil to be re-used.

1.03 REFERENCE STANDARDS

A. AASHTO M 14 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.

B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3 .

D. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

E. ASTM D155 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2, 00 kN m/m3 .

F. ASTM D216 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

G. ASTM D248 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System .

H. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth ; 2005.

I. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.

D. Compaction Density Test Reports.

1.05 QUALITY ASSURANCE

A. The Contractor shall employ and pay for services of the independent testing laboratory for tests required to show compliance with the specifications. Submit test results directly to the Owner/Engineer. Selection of the testing laboratory is subject to approval of the Owner/Engineer.

B. Determine moisture density relations of soils encountered during construction in accordance with standard proctor method. Provide graph of proctor soil density versus water content for all backfill material.

C. Provide gradation and materials tests for pipe bedding and stabili ing material.

D. Test trench backfill soil density and moisture at one test per lift per 400 S of trench under paved and/or unpaved areas.

E. Reference to percent maximum density shall mean a soil density not less than the stated percentage of maximum density for soil as determined by ASTM D698, "Moisture Density Relations of Soils" Standard Proctor Method.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where designated by Owner.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

C. Verify that survey bench marks and intended elevations for the Work are as indicated on Drawings.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill material under parking lots, streets, or other paved areas: Use Subsoil excavated on-site or from off-site borrow area. General fill material to be free of foreign substance, debris, large stones, rocks, roots, organic or fro en material, expansive material and other deleterious materials.
   1. Use for backfill against and under concrete foundations, walls, and slabs.
   2. Follow Fill Placement recommendations of CS19 51-125

B. Imported Fill:
   1. For use as backfill against and under concrete foundations, walls, and slabs as an alternate
   2. Granular material consisting of clean, well-graded, mineral particles.
      a. Si e and Grading: Maximum of less than 10-40 passing the 200 sieve.
      b. Free of lumps and rocks greater than 2inches, and free of debris.
      c. Import fill similar to the on-site materials may be suitable.

C. Granular Fill - Gravel : Pit run washed stone; free of shale, clay, friable material and debris.
   1. Graded in accordance with ASTM C136/C136M, within the following limits:
      a. 2 inch sieve: 100 percent passing.
      b. 1 inch sieve: 95 percent passing.

D. Granular pipe bedding for pipe 4" to 18" in diameter: Clean crushed stone; comply with following gradation, dependent upon pipe diameter.
   1. For sieve si e of 1": 100 percent passing.
   2. For sieve si e of 3/4": 80 to 95 percent passing.
   3. For sieve si e of 1/2": 35 to 60 percent passing.
   4. For sieve si e of 3/8": 20 to 40 percent passing.
   5. For sieve No. 4: 0 to 5 percent passing.

E. Granular pipe bedding for pipe over 18" in diameter: Clean crushed stone; comply with following gradation, dependent upon pipe diameter.
   1. For sieve si e of 1-1/2": 100 percent passing.
   2. For sieve si e of 1": 95 to 100 percent passing.
   3. For sieve si e of 3/4": 35 to 0 percent passing.
   4. For sieve si e of 1/2": 25 to 50 percent passing.
   5. For sieve si e of 3/8": 10 to 30 percent passing.
   6. For sieve No. 4: 0 to 5 percent passing.

F. Alternate granular pipe bedding material: IDOT 4120.04 Class A crushed stone may be used in stable trench conditions.

G. Stabili ing Material: Sharp, clean crushed stone; comply with following gradation:
   1. For sieve si e of 2-1/2": 100 percent passing.
   2. For sieve si e of 2": 90 to 100 percent passing.
   3. For sieve si e of 1-1/2": 35 to 0 percent passing

4. For sieve si e of 1": 0 to 15 percent
5. For sieve si e of 1/2": 0 to 5 percent passing.

2.02 ACCESSORIES

A. Filter Fabric: Manufacturer's standard non-woven pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.
   1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D4 59 and the referenced standard test methods in parenthesis:
      a. Grab Tensile Strength (ASTM D4632 : 100 pounds.
      b. Apparent Opening Si e (ASTM D4 51 : 100 U.S. Standard Sieve.
      c. Permeability (ASTM D 4491 : 150 Gallons per minute per square foot.

2.03 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analy e samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

C. Verify structural ability of unsupported walls to support imposed loads by the fill.

D. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 BEDDING AND BAC FILL FOR TRENCHES

A. Place bedding from bottom of pipe trench to pipe spring line as indicated on applicable Typical Detail Drawings. Bedding includes material below bottom of pipe as specified. Compact bedding below bottom of pipe prior to installation of pipe to minimi e settlement.

B. Use caution when placing and compacting backfill to avoid placing construction loads on pipe which may damage or displace newly laid pipe.

C. Bedding for Gravity Lines:
   1. Granular pipe bedding material as specified.
   2. Thickness of bedding material below the bottom of pipe barrel: 1/8 pipe O.D., 4" (100 mm minimum.
   3. Compact in 6" (150 mm lifts from trench bottom to pipe spring line.
   4. Compact to a minimum of 90 Standard Proctor Density (ASTM D698 .

D. Bedding for Pressure Lines:
   1. Native select material as specified or granular pipe bedding material.
   2. No bedding required where rock or other unyielding material is encountered in trench bottom, provide a cushion of granular pipe bedding with thickness as shown on Typical Detail Drawing.
   3. Compact bedding and cushioning materials in 6" (150 mm lifts from trench bottom to pipe spring line.
   4. Compact backfill material to a minimum 90 percent Standard Proctor density (ASTM D698 .

5. Construct structures and appurtenances and perform backfilling as work progresses.

E. Construct manholes and appurtenances and perform backfilling as work progresses.

F. Backfill with material removed from excavation except where imported backfill is specified; use no debris, fro en earth, large clods, stones, or other unsuitable material. If native material is too wet or dry to achieve specified compaction, Contractor required to dry or wet material or replace with approved imported material at no additional cost to the Owner.

G. Percent maximum density shall mean a soil density no less than the stated percent of optimum density for soil as determined by ASTM D698, Standard Proctor Density or ASTM D155 , Modified Proctor Density.

H. Rocks 1-1/2" (3 mm in diameter and larger, wood, fro en earth, clods of earth and/or hard, bulky materials shall be considered as spoil materials and shall not be used as selected material for bedding, initial and trench backfill. Dispose of spoil material by hauling materials to a suitable disposal site obtained by the Contractor.

I. Backfill simultaneously on both sides of pipe to prevent displacement.

. Place backfill into trench at an angle to minimi e impact on installed pipe.

. Initial Backfill:
1. Ductile Iron Pipe, Polyvinyl Chloride (pressure and Reinforced Concrete Pipe: Material and compaction specified for trench backfill.

L. Backfill trench immediately after location of connections and appurtenances have been recorded. Conform to applicable Typical Detail Drawings contained herein.

M. Placement of Backfill:
1. Place initial backfill material only after installation of pipe and bedding material has been completed.
2. Place all initial backfill in such a manner so not to damage or displace pipe.
3. Compact to minimi e settlement of trench backfill and provide optimum support of pipe.

N. Place trench backfill only after initial backfill has been placed, compacted, and approved. Trench backfill, material and compaction requirements depend on what area the pipe is located beneath as specified. Trench backfill begins 1'-0" (1/3 m above pipe barrel and terminates at final grade or subgrade.

O. Trench Backfill:
1. Open Rural Areas: In open rural areas where there is no vehicular traffic, such as fields, and along railroads, no special compaction will be required. Backfill is select material. The material may be placed with bulldo ers or backfilling machines of other types. Mound earth approximately 12" (300 mm in height over trench; mound shall be neatly rounded off for further settlement. Level trench surface after settling.
2. Grass Parking Areas and Unpaved Areas: Select materials as previously defined. Compact backfill material to a minimum of 90 Standard Proctor Density (ASTM D698 . Fill upper portion of trench in grass areas with 8" minimum of topsoil.
3. Paved Areas: Select material compacted in 8" (150 mm lifts with pneumatic or mechanical tampers to finish grade or subgrade. Compact to a minimum of 95 Standard Proctor Density (ASTM D698 .

3.04 FILLING

A. Backfill voids resulting from demolition and excavation to obtain grade required around structures.

B. Fill to contours and elevations indicated using unfro en materials.

C. Employ a placement method that does not disturb or damage other work.

D. Backfilling around structures:
1. Where watertightness test is not required, backfilling around structures may begin after the concrete has reached 100 of the specified compressive strength, or after a minimum of days, whichever is longer. Where watertightness test is required, backfilling around structures may not begin until after the watertightness test has been successfully passed.

2. Prevent displacement of structural components during backfilling operations. Backfill opposite sides simultaneously with a maximum backfill elevation difference of 6 feet.
3. For walls that are unbraced at the top edge, backfill can be place upon concrete reaching required strength, as noted above.
4. For walls that are braced at the top edge, backfill can be placed only when the next level floor framing or cover slabs are in place and the concrete has reached the required strength, as noted above.

E. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, fro en or spongy subgrade surfaces.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Placement:
1. Maintain surfaces free of water, debris, and excessively wet, fro en , and other deleterious materials.
2. Place and compact backfill materials in loose lifts not exceeding 9 inches in thickness

H. Granular Fill: Place and compact materials in equal continuous layers not exceeding 8 inches compacted depth.

I. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

. Correct areas that are over-excavated.
1. Load-bearing foundation surfaces: Use general fill, flush to required elevation, compacted to 98 percent of maximum dry density.
2. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

L. Compaction Density Unless Otherwise Specified or Indicated:
1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
2. Under Footings: Material shall be compacted to at least 98 percent of its maximum Standard Proctor Dry Density, ASTM D 698.
3. Wall backfill and backfill adjacent to structures not supporting other structures: Material shall be compacted to at least 95 percent of its maximum Standard Proctor Dry Density, ASTM D 698.

M. Reshape and re-compact fills subjected to vehicular traffic.

N. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Engineer. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

O. Pneumatic tired rollers or heavy vibratory compactors shall not be used within 6 ft. (2 m of structure, walls, pipes, or other construction which might be damaged by compaction equipment.

3.05 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. At Foundation Walls:
1. Use general fill, except where granular bedding is specified; use no debris, fro en earth, large clods, stones, or other unsuitable material.
2. Fill up to finish grade elevation as shown on Drawings; dispose of excess excavated material as directed by Engineer.
3. Do not backfill against unsupported Structures.
4. Backfill simultaneously on each side of structures; protect structures from damage at all times.

C. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:
1. Cover drainage fill with general fill.

2. Compact to 95 percent of maximum dry density.

3.06 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D216 , ASTM D2922, or ASTM D301 .

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D 155 ("modified Proctor" , ASTM D 698 ("standard Proctor" , AASHTO T 180, ASTM D 155 ("modified Proctor" , ASTM D 698 ("standard Proctor" , AASHTO T 180, ASTM D 155 ("modified Proctor" , or ASTM D 698 ("standard Proctor" .

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests:
   1. Take soil density tests uniformly throughout the placing of fill material so that quality control can be maintained at all times. Minimum requirements are as follows:
      a. One field density test for each 25 C of structural fill, minimum one each lift.
      b. One field density test for each 50 C of controlled fill, minimum one each lift.
      c. One field test per day for each type of fill on any day when fill is placed, regardless of quantity.

3.07 CLEANING

A. Clean up each portion of construction as it is completed.

B. Remove unused stockpiled materials, rubbish, and debris and leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 31 2323

SECTION 31 5000
EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Designing, providing, and maintaining shoring, sheeting, and bracing necessary to support the sides of excavations or trenches and to protect the safety of workers and public, to prevent detrimental settlement and lateral movement of existing facilities, adjacent property, and completed work.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Drawings showing excavation support and movement monitoring plans and materials.
   1. Details of shoring, bracing, sloping, or other provisions for worker protection.
   2. Methods and sequencing of installing excavation support.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 5 2/A 5 2M, or ASTM A 690/A 690M; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of si e and strength required for application

E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

F. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

G. Tiebacks: Steel bars, ASTM A 22/A 22M.

H. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 3 EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other ha ards that could develop during excavation support and protection system operations.

3.02 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches (1500 mm . Accurately align exposed faces of sheet piling to vary not more than 2 inches (50 mm from a hori ontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.03 TIEBAC S

A. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
   1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system. Contractor is responsible for this observation and testing, Owner shall not pay for this testing.
   2. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

3.04 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
   1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
   2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
   3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.05 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
   1. Fill voids immediately with approved backfill compacted to density specified in Section 31 2323 - Fill.
   2. Repair or replace, as approved by Engineer, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 31 5000

SECTION 33 3123
SANITARY SE ERAGE FORCE MAIN PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewerage force main and inverted siphon piping, fittings, and accessories.

B. Connection of facility sanitary force main and inverted siphon system to headworks.

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Excavation: Excavating of trenches.

B. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

C. Section 31 2323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

B. ASTM D2 4 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

C. ASTM D3035 - Standard Specification for Polyethylene (PE Plastic Pipe (DR-PR Based on Controlled Outside Diameter.

D. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Material.

E. ASTM F2620 - Standard Practice for Heat Fusion oining of Polyethylene Pipe and Fittings.

F. AWWA C20 - Steel Pipe Flanges for Waterworks Service, Si e 4 In. Through 144 In. (100 mm Through 3,600 mm .

G. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.

H. MSS SP-25 - Standard Marking System for Valves, Fittings, Flanges and Unions.

1.04 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Product Data: Manufacturer's data sheets for each item of equipment and material provided, showing compliance with requirements; include materials, pressure ratings, seats and seals, clearances for operation and maintenance, and other characteristics.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

E. Hydrostatic Test Report: Document results of field quality control testing. Submit copies of all reports of field tests.

F. Project Record Documents:
   1. Record location of piping, connections, valves, valve vaults, valve manholes, thrust restraints, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

G. Maintenance Materials:
   1. For Each Type and Si e of Valve:
      a. Lubricator, lubricant of appropriate temperature rating, lubricator/isolating valve.
      b. Gaskets; two each.
      c. O-ring seals; two each.
      d. Diaphragms (molded ; two each.
      e. Other parts made of elastomeric materials; two each.
      f. Stem packing; two each.
      g. Seat rings; two each.
   2. One set of special tools necessary for adjustment, operation, maintenance and disassembly.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not damage pipe, fittings and accessories, and pipe coatings during delivery, handling, and storage.

B. Do not place materials on private property without written permission of property owner.

PART 2 PRODUCTS

2.01 FORCE MAIN PIPE MATERIALS

A. Provide products that comply with applicable code(s .

B. Polyethylene (PE Pipe: ASTM D3350 and ASTM D3035, Polyethylene (PE material (DR-PR , minimum pressure rating of 100 psi, at 3.4 degrees F. Thermal butt fusion joints and fittings in accordance with manufacturer's recommendations; pipe and fittings same material utili ing transition fittings when connecting to existing piping.
   1. oints:
      a. Heat Fusion oints: ASTM F2620.
      b. Mechanical oints: ASME B16.1.
      c. Flanged oints: ASME B16.1 or AWWA C20 .

C. Fittings: Same material as pipe molded or formed to suit pipe si e and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 VALVE APPLICATIONS

A. Valve Applications: Provide valves as follows whether shown on layout drawings or not.

B. Do not direct-bury flanged valves; provide valve vault or manhole as indicated on layout drawings.

2.03 REQUIREMENTS APPLICABLE TO ALL VALVES

A. See layout drawings for valve si es, valve ratings, operator types, and piping types and si es.

B. Provide valves suitable for the service indicated and coordinated to piping system.
   1. Provide valves that will withstand working pressure indicated or working pressure of pipe to which valve is connected, whichever is greater.
   2. Provide valves of si es indicated or of port diameter/area equal to that of pipe to which valve is connected, whichever is larger.
   3. Provide valves that open by turning counterclockwise, with direction of opening integrally marked on operating nut or operator.
   4. Valve End Connections: As indicated; if not indicated, provide end connections of the same type as indicated for joints in pipe to which valve is connected.
   5. Factory install operators and accessories.

C. Identification and Tagging: Mark valves in accordance with MSS SP-25 using identification tags securely attached; on tags show the service, valve identification number from layout drawings, manufacturer's name and model number.
   1. Identification Tags: 1.3 5 inches diameter, minimum; engraved laminated plastic with black lettering.
   2. Attachment: No. 12 AWG copper wire.

2.04 GATE VALVES - METAL BODY

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Manufacturers:
   1. Grinnell Products: www.grinnell.com/ sle.
   2. Hammond Valve: www.hammondvalve.com/ sle.
   3. Milwaukee Valve Company: www.milwaukeevalve.com/ sle.
   4. Weir Power Industrial; The Weir Group PLC: www.weirpowerindustrial.com/ sle.

C. Gate Valves - Si es 3 inches and Larger: Solid wedge type with clear waterway equal to full diameter of valve. Comply with AWWA C500.
   1. Rating - Si es 12 inch Diameter and Smaller: 200 psig.

2. Bonnet: Outside screw and yoke (OS , bolted type.
3. Disc: Iron; with nonrising stems with backseats.
4. End Connections: Flanged.
5. End Connections: Threaded.
6. End Connections: Mechanical joint.
. End Connections: Push-on.

2.05 CHEC VALVES

A. Check Valves - General Requirements: These requirements apply to all check valves unless otherwise indicated.
1. Function: Permit free flow forward and provide positive check against backflow.
2. Rating: 150 psig.
3. Body: In metallic pipelines, iron body; in thermoplastic pipelines, thermoplastic body of same material as pipe.
4. Identification: Directly cast on body; manufacturer's name, initials, or trademark; si e of valve, working pressure; direction of flow.

2.06 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in Section 31 2316.13.

B. Pipe Bedding Material: As specified in Section 31 2323.

C. Pipe Cover Material: As specified in Section 31 2316.13.

D. Pipe Cover Material: As specified in Section 31 2323.

PART 3 EXECUTION

3.01 GENERAL

A. Perform work in accordance with applicable code(s .

3.02 EXCAVATION, TRENCHING, AND BAC FILLING

A. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Form and place concrete for pipe thrust restraints at bends, tees, and each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide sq ft thrust restraint bearing on subsoil.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling. Correct over-excavation. See Section 31 2316.13 for additional requirements.

D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling. Correct over-excavation. See Section 31 2323 for additional requirements.

3.03 PREPARATION

A. Cut pipe ends square with mechanical cutters. Use wheel cutters where practicable. Remove burrs, sharp and rough edges and grind smooth. Remove loose material from pipe before laying.

3.04 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories at the locations indicated on layout drawings and in accordance with manufacturer's instructions. Seal watertight.
1. Polyethylene (PE Plastic Pipe: Comply with ASTM D2 4.

B. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

C. Connect to building sanitary sewer outlet and municipal sewer system, through installed sleeves.

3.05 OINTING

A. Polyethylene (PE Pipe:
1. Heat Fusion oints: Comply with manufacturer's instructions concerning equipment, temperature, melt time, heat coat, and joining time.
2. Installation of Mechanical oints: Comply with manufacturer's instructions.

3. Installation of Flanged oints: Comply with manufacturer's instructions.

3.06 INSTALLATION - VALVES

A. Install in accordance with manufacturer's instructions.

B. Clean valves of foreign matter prior to installation and inspect for damage. Fully open and close valves to verify parts are properly operating.

3.07 INSTALLATION - VALVE BOXES

A. Install valve boxes over each outside gate valve, unless otherwise indicated on layout drawings. Center valve boxes over valve. Tamp fill around each valve box to a distance of 4 feet on each side or to undisturbed trench face, if less than 4 feet.

3.08 INSTALLATION - VALVE VAULTS

A. Establish elevations and pipe inverts for inlets and outlets as indicated on layout drawings.

B. Form bottom of excavation clean and smooth to correct elevation.

C. Form and place cast-in-place concrete base pad, with provision for force main pipe end sections.

END OF SECTION 33 3123

SECTION 33 4211
STORM ATER GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete Storm Pipe for use as Pipe anchor.

1.02 REFERENCE STANDARDS

A. AASHTO M 1 0 Circular Concrete Pipe.

B. ASTM C 6 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

C. ASTM C 6M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric .

D. ASTM C443 - Standard Specification for oints for Concrete Pipe and Manholes, Using Rubber Gaskets.

E. ASTM C443M - Standard Specification for oints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric .

1.03 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Include one copy of results of tests and certification reports with each shipment of materials.

C. Product Data: Provide data indicating pipe and pipe accessories, castings and precast products. Indicate special procedures required to install products specified.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Contractor shall employ and pay for services of the independent testing laboratory for tests required to show compliance with the specifications. Test results shall be submitted directly to Owner/Engineer. Selection of the testing laboratory is subject to approval of Owner/Engineer.

B. Certify that pipe materials and special fittings are manufactured in accordance with applicable specifications. Provide copies of concrete cylinder compression tests made during manufacture of precast materials.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to Manufacturer's recommendations and under provisions of Section 01 6000.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with applicable code for materials and installation of the Work of this section.

2.02 STORM SE ER PIPE MATERIALS

A. Concrete Pipe: Reinforced, ASTM C 6 (AASHTO M1 0 , Class III (2000D with Wall type B; mesh reinforcement. inside nominal diameter 18 in
   1. Reinforced Concrete Pipe oint Device: ASTM C 443 (ASTM C 443M , continuous O-ring rubber gasket joint. Separation between joints shall be minimi ed.

PART 3 EXECUTION

3.01 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions.

B. Where indicated on the Drawings, the Contractor will be required to create concrete dog houses to anchor suction line pipe to the bottom of lake.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 01 4000 - Quality Requirements.

END OF SECTION 33 4211

SECTION 33 4413
PAC AGED STORM ATER PUMPING STATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-engineered, prefabricated assemblies comprising pump(s , valve(s , internal piping, and controls.

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Excavation.

B. Section 31 2323 - Fill: Backfilling.

1.03 REFERENCE STANDARDS

A. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

B. ISO 21940-11 - Mechanical vibration -- Rotor balancing -- Part 11: Procedures and tolerances for rotors with rigid behaviour.

C. ISO 2858 - End-Suction Centrifugal Pumps (Rating 16 Bar -- Designation, Nominal Duty Point and Dimensions.

D. ISO 5199 - Technical specifications for centrifugal pumps -- Class II.

E. NEMA MG 1 - Motors and Generators.

F. NFPA 0 - National Electrical Code.

1.04 SUBMITTALS

A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.

B. Product Data: Manufacturer's technical literature for prefabricated assemblies and pump chamber and access way; include installation instructions.
   1. Control and power instrumentation and panels.
   2. Pump curves.
   3. Motor data.
   4. Specimen warranty.
   5. Provide the following motor/pumps design information prior to final turnover - number of motor rotor bars and stator slots; number of cooling fan blades; RPM of motor; bearings, bearing manufacturer, bearing type, bearing style and number of balls/elements; number of commutator bars and commutator brushes; SCR firing frequencies; and number of pump impellers.

C. Shop Drawings: Detailed drawings of entire pumping station, combining components furnished by different manufacturers, if any.
   1. Control panel schematic diagrams.
   2. Show the design of the chamber, with dimensions, types, and thicknesses of materials, and elevation levels with reference to those elevations indicated.

D. Sustainable Design Documentation: Amount of cement replaced by alternative materials.

E. Manufacturer's Qualification Statement.
   1. Submit a listing of product installations similar to the package lift station being installed.

F. Operating and Maintenance Data:
   1. Submit preventative maintenance and inspection procedure for package lift stations.
   2. Include in procedures the frequency of preventative maintenance, inspection, adjustment, lubrication, and cleaning necessary to minimi e corrective maintenance and repair.
   3. Submit spare parts data, including a complete list of parts and supplies with current unit prices and source of supply.
   4. List parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as a part of the contract, and list additional items recommended by the manufacturer to ensure an efficient operation for a period of one year.

G. Executed Warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company speciali ing in manufacturing products specified in this section, with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements for additional requirements.

1.07 ARRANTY

A. Warranty: Provide manufacturer's warranty for packaged pump station, with itemi ed list of components covered by warranty; include list of specific operation and maintenance procedures that are required to keep warranty valid.

PART 2 PRODUCTS

2.01 PAC AGED STORM ATER PUMPING STATIONS

A. Manufacturers:
   1. Watertronics
   2. Or Equal
      Note: Watertronics is basis of design and if contractor proceeds with another manufactuer any adjustments to make it work is on them.

B. Packaged Stormwater Pumping Stations: Pre-engineered duplex stormwater pump station, including pre-frabricated, self-contained variable speed hori ontal centrifugal pump station with piping, valves, enclosure, internal wiring, controls, and other necessary components for continuous, unattended, automatic operation.
   1. Furnish all components factory-assembled to greatest extent possible; where field installation is required, provide piping, wiring, and other components as required for a complete installation.
   2. Configuration: Two primary pumps to convey stormwater, a secondary pump to feed self cleaning inlet screen and controls mounted at grade in weatherproof enclosure provided as part of packaged equipment.
   3. Service Life: 15 years.
   4. Pumping Capacity (each pump : 150 gallons per minute, minimum.
   5. Dynamic Head: 5 feet.
   6. Finish all components in accordance with manufacturer's standard practice for stormwater resistance.
   . Suction shall have a self cleaning inlet screen.

C. Anchors and Fasteners: Stainless steel.

D. Identification: For each item of equipment, provide the manufacturer's name or trademark and model number on corrosion-resistant identification plate, cast integrally, stamped, or otherwise permanently marked in conspicuous place; for pumps, include pump capacity in gallons per second and liters per minute, pump head in feet and meters, speed of rotation, and direction of rotation.

2.02 VALVES AND PIPING

A. Valves: Provide one gate valve and one check valve on each pump discharge line

2.03 PIPING

A. Use flanged connections for exposed piping and mechanical connections for buried piping.

B. Terminate discharge lines as indicated on plans.

C. Accessories: Provide fittings, flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required.

2.04 CONTROL FUNCTIONS AND INSTRUMENTATION

A. Automatic Controls: Provide automatic controls for pump and other equipment operation, with local manual controls.
   1. Provide manual controls as indicated.
   2. Provide remote indication corresponding to all local indication.
   3. Provide remote controls corresponding to all manual controls.

B. Pump Controls: Provide controls capable of operating pumps individually, depending on load conditions.

2.05 PO ER

A. Electrical Power Available: 230 volts AC, single phase, 60 H .

B. Wiring and Conduit: Meet or exceed requirements of NFPA 0.

C. Control Wiring: 18 AWG, minimum, in plastic wireway with snap-on cover, bundled and tie wrapped neatly.

D. Ha ardous Locations: Where pumps are specified to be explosion proof, provide pump power and control installation that meets NFPA 0 requirements for Class 1, Division 1, Group D Ha ardous Location, including intrinsically safe controls, with components that are UL listed or FM approved.

E. Control Panel: NEMA 3R, Type 300 series stainless steel construction, with hinged door and hinged dead front; si ed to accommodate all components; factory wired and tested.
   1. Internal Wiring: Stranded copper conductors rated at 194 degrees F, with conductor terminations as recommended by device manufacturer.
   2. Door: Minimum 180 degrees opening, rubber gasket weatherproof seal, 3-point latch, and padlockable handle.
   3. Permanently identify all devices as they are indicated on final as-built drawings; identify on front of door, front of dead front, and on back plate.

F. Provide the following, at minimum, mounted on or in panel door:
   1. Alarm indication.
   2. Identification Plate: Engraved to show uppercase white letters on black background, reading:
      a. "LIFT STATION CONTROL PANEL".
      b. System voltage (e.g. 208V, 3PH or 480V, 3PH .
      c. Power source.

2.06 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Test pump, valve, and piping assembly in factory prior to shipping, at test pressure equal to 50 percent more than pump discharge pressure or total dynamic head, whichever is greater.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify inlet and discharge piping connection match si e, location, and elevation shown on drawings.

3.02 INSTALLATION

A. Install as indicated, in accordance with drawings and manufacturer's instructions.

B. Where equipment is mounted on concrete, grout attachments before connecting piping.

C. Set water level controls at elevations indicated; if not indicated, obtained Owner's instructions as to levels.

D. Attach final as-built drawings of components in enclosure, and controls, laminated in mylar, to inside of pump station front door; include legends and pump nameplate data.

E. Install on or near pump station, complete package of posted instructions, consisting of labels, signs, and operating instructions.

3.03 MANUFACTURER FIELD SERVICES

A. Provide the services of equipment manufacturer's technical representative to direct startup of station and instruct Owner's personnel in startup, operation, and maintenance procedures.

3.04 FIELD QUALITY CONTROL

A. Where components are mounted on or in concrete, wait minimum of 5 days after concrete placement before testing.

B. After installation but before backfilling or connecting to piping, test pump, valve, and piping assemblies under test pressure equal to 50 percent more than pump discharge pressure or total dynamic head, whichever is greater, using clean water. Backfill in accordance with Section 31 2323.
   1. Simulate varying water level conditions to show that pump controls are working properly.
   2. Activate each control function to check for proper operation and indication.

C. After connecting to piping, monitor operation for 10 days and submit report.

END OF SECTION 33 4413

SECTION 46 0500
EQUIPMENT INSTALLATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment Installation Requirements.

1.02 REFERENCES

A. ANSI B31.1 - Code for Power Piping.

B. ASME - Boiler and Pressure Vessel Code.

C. AWS D1.1 - Welding in Building Construction.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate location and extent of proposed field welding, and provisions that have been made for type of base metal, present stress conditions, and preheating requirements.

C. Submit certificates for each welder, indicating proof of qualifications as outlined in code, prior to any field welding, either temporary or permanent.

1.04 DELIVERY, STORAGE, AND PROTECTION

A. Receive and unload shipments to plant site from suppliers of equipment under this contract.

B. Unload equipment as soon as possible after arrival.

C. Pay freight car and truck demurrage, detention, and any other costs which may be billed to Owner due to failure to unload cars or trucks within time required by freight companies.

D. Provide physical protection for equipment placed in storage.

1. Stored equipment shall be supported above ground and shall be covered with canvas or other heavy-duty sheeting. Cover shall be securely fastened and shall be replaced if torn or otherwise damaged during storage period.
2. Motors shall be stored in dry, warm place and in accordance with manufacturer's recommendations. Motors over 20 hp shall have shaft rotated 90° each month. Provide Engineer with evidence that this requirement is met.
3. Desiccant shall be maintained between cover and motor frames on motors. Provide desiccant of type permitting visual determination of condition of desiccant. Replace desiccant when it becomes ineffective.
4. Following items shall be stored in weatherproof, heated (minimum 50°F building complete with bins for storage of small pieces of equipment.
    a. Electronic instruments and cabinets.
    b. Electrical equipment with general purpose enclosures.
    c. Insulation materials.
    d. Rotating equipment.
    e. Miscellaneous electronic equipment, gaskets, and small machined parts.
    f. Instruments and controls.

E. Inspect stored equipment weekly. Renew protective coatings as necessary to preserve fitness of equipment.

F. Provide for safekeeping of materials or equipment received. Store and maintain materials and equipment after receipt until completed installation is accepted by Owner. Such storage and maintenance shall be in accordance with manufacturer's recommendations and requirements of these Specifications. Provide materials, equipment, and labor required for such storage and maintenance.

G. Contractor shall be accountable for any deterioration of materials or equipment occasioned by improper storage or maintenance, and shall recondition, repair, or replace any such materials or equipment without additional cost to Owner.

1.05 SERVICE REPRESENTATIVE

A. Provide qualified service representative to perform functions described in Section 01 4000 and to sign Certificate of Proper Inspection attached to Section 01 4000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Before assembly or erection, thoroughly clean equipment of temporary protective coatings and foreign materials; completely remove shop-applied flushing compounds.

B. Blow out with compressed air as required to remove foreign material.

C. After erection of equipment, clean external surfaces of oil, grease, dirt, or other foreign materials; touch up shop paint, primer, and filler; leave surfaces smooth and ready for finish painting.

3.02 INSTALLATION

A. Install in strict accordance with manufacturer's instructions.

B. Provide access space around equipment for service. Provide no less than minimum as recommended by manufacturer.

3.03 SPECIAL ERECTION PROCEDURES

A. Field welding to existing structural members shall conform to following requirements:
   1. Conform to AWS D1.1.
   2. Welding to high strength steels or preheating of highly-stressed members will not normally be permitted.
   3. Remove any temporary welded attachments, grind area smooth, and apply one coat of primer to match existing primer.

B. Remove any temporary attachments made to equipment. Grind area of attachment on equipment to smooth surface and apply one coat of primer to match existing primer.

3.04 SPECIAL EQUIPMENT TO BE PROVIDED

A. Provide dowel pins and shims necessary for leveling and doweling equipment to baseplates. Shims shall be stainless steel.

B. Provide bolting required to anchor equipment securely to building structural steel; holes required in structural steel shall be drilled; burning with cutting torch not allowed.

C. Provide expansion anchors where required, subject to review by Engineer. Use appropriate type of anchor devices on vibratory equipment.

D. Provide welding rod for field erection of equipment installed under this contract.

3.05 FLOOR SHORING

A. Shore any parts of structure for which design loading would be exceeded during construction or installation of equipment.

B. Protect flooring and other finished surfaces by means of heavy planking.

C. Remove shoring and repair any damage to floors or other parts of structures after equipment has been installed.

3.06 EQUIPMENT ALIGNING

A. Align equipment in accordance with manufacturer's recommendations.

B. Use shims of sheet and plate steel; use shims with laminations having individual layers not heavier than 0.015" for 1/32" to 1/8" directly under equipment.

C. Check alignment of equipment after piping and other external connections have been made and before equipment is placed in operation. Realign equipment as necessary.

D. After alignment, hot run and recheck alignment; drill and ream items of equipment and fasten to baseplates with tapered dowel pins.

E. Include costs for labor required to obtain alignment within allowable limits on equipment installed and for any hanger adjustments required.

3.07 EQUIPMENT SUPPORTS

A. Provide devices to support equipment.

B. Fabricate supports of structural steel sections, plates, or rods arranged to provide rigid and sturdy mounting for equipment.

C. Provide connections or fasteners required between equipment supports and building structure.

D. Equipment foundation pads: As indicated on drawings.

E. Provide devices to support equipment piping and appurtenances where specific support is not detailed on Drawings. Support piping adjacent to equipment such that no weight is carried on equipment.

3.08 GROUTING

A. Place a minimum of 1" nonshrink grout under equipment being mounted on concrete foundations unless specified otherwise.

B. Determine quantity of grout required.

C. Space between top of foundation and bottom of equipment base shall be filled with grout, free of any voids.

D. Place no grout that has been allowed to set, after mixing, beyond time limitations set forth by grout manufacturer.

END OF SECTION 46 0500

Appendix C – Dory Lake Construction Plans

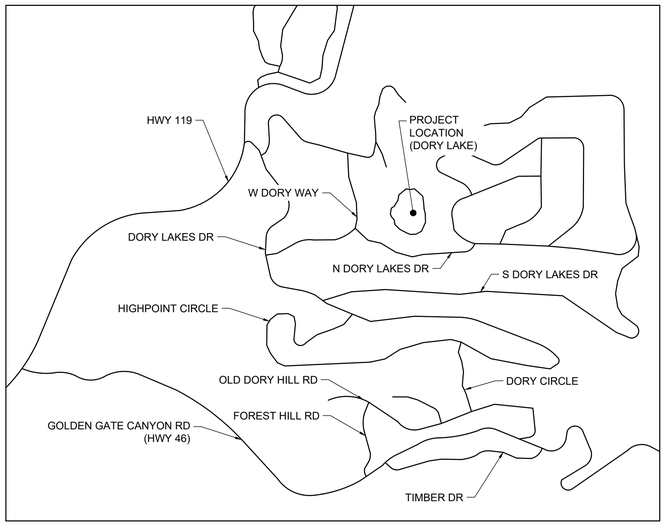
DORY LAKE PUMP REPLACEMENT PROJECT

GILPEN COUNTY, CO

2024

SHEET INDEX

LOCATION MAP



VICINITY MAP
1"=1000'

NORTH

HRGreen

BENCHMARK:
NGS CONTROL POINT NUMBER M 266 BEING A 3 BRASS DISK SET IN A LARGE BOULDER STAMPED 'M 266 1940' LOCATED 5.6 MILES SOUTH ALONG STATE HIGHWAY 119 FROM THE DENVER AND SALT LAKE RAILWAY STATION AT ROLLINSVILLE, GILPIN COUNTY, 160 FEET EAST OF HIGHWAY STAKE 420, 45 FEET SOUTH OF THE CENTERLINE OF THE HIGHWAY, AT THE NORTH EDGE OF A GRANITE OUTCROP, IN THE TOP OF A 3-FOOT GRANITE BOULDER, AND 1 FOOT ABOVE GROUND.

ELEVATION = 8904.80' (NAVD88)

PROJECT COORDINATES ARE MODIFIED COLORADO STATE PLANE NORTH ZONE 83(2011) COORDINATES. PROJECT COORDINATES ARE DERIVED FROM STATE PLANE COORDINATES USING THE FOLLOWING FORMULAS:

PROJECT NORTHING = (STATE PLANE NORTHING * 1.0004464476) – 1000000.00'
PROJECT EASTING = (STATE PLANE EASTING * 1.0004464476) – 3000000.00'

CERTIFICATION

COLORADO LICENSED — GREGORY L. PANZA — 37081 — PROFESSIONAL ENGINEER

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Colorado.

GREGORY LOUIS PANZA, P.E. DATE
License Number: 37081
My license renewal date is October 31, 2025.
Pages or sheets covered by this seal:
-

COLORADO LICENSED — KEVIN S. SPARROW — 47762 — PROFESSIONAL ENGINEER

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Colorado.

KEVIN S. SPARROW, P.E. DATE
License Number: 47762
My license renewal date is October 31, 2025.
Pages or sheets covered by this seal:
-

COLORADO LICENSED — JEREMY D. MIRONAS — 47175 — PROFESSIONAL ENGINEER

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Colorado.

JEREMY D. MIRONAS, P.E. DATE
License Number: 47175
My license renewal date is October 31, 2025.
Pages or sheets covered by this seal:
-

ENGINEER'S STATEMENT
THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE COUNTY FOR DETAILED ROADWAY, DRAINAGE, GRADING AND EROSION CONTROL PLANS AND SPECIFICATIONS, AND SAID PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH APPLICABLE MASTER DRAINAGE PLANS AND MASTER TRANSPORTATION PLANS. SAID PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR ROADWAY AND DRAINAGE FACILITIES ARE DESIGNED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THESE DETAILED PLANS AND SPECIFICATIONS.

DATE

GREGORY PANZA PE # 37081

OWNER'S STATEMENT
I, THE OWNER/DEVELOPER HAVE READ AND WILL COMPLY WITH THE REQUIREMENTS OF THE GRADING AND EROSION CONTROL PLAN AND ALL OF THE REQUIREMENTS SPECIFIED IN THESE DETAILED PLANS AND SPECIFICATIONS.

RYAN KEENAN
GILIPIN COUNTY
DATE

ENGINEER CONTACT(S):
HR GREEN DEVELOPMENT, LLC
GREG PANZA, P.E.
5613 DTC PARKWAY | SUITE 950
GREENWOOD VILLAGE, CO 80111
PH: 720-602-4999
gpanza@hrgreen.com

5613 DTC PARKWAY, SUITE 950 | GREENWOOD VILLAGE, COLORADO 80111
Phone: 720.602.4999 | Toll Free: 800.728.7805 | HRGreen.com

BAR IS ONE INCH ON OFFICIAL DRAWINGS.
0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

HRGreen
HR GREEN - DENVER
5613 DTC PARKWAY | SUITE 950
GREENWOOD VILLAGE, CO 80111
PHONE: 720.602.4999
FAX: 844.273.1057

DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

GENERAL
COVER SHEET

SHEET G.001

01

CIVIL LEGEND

SYMBOLS, ABBREVIATIONS, AND LINETYPES LEGEND

- STORM INLET TYPE R
- STORM END SECTION
- STORM MANHOLE
- SANITARY MANHOLE
- FIRE HYDRANT
- LIGHT POLE
- WATER VALVE
- CONTROL POINT
- PROPERTY LINE
- ROAD CENTERLINE
- RIGHT-OF-WAY LINE
- PROPOSED DRAINAGE
- 5250 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 5250 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- FLOW ARROW
- PROPOSED 100-YR FLOODPLAIN
- EFFECTIVE 100-YR FLOODPLAIN
- LIMITS OF DISTURBANCE
- POTENTIAL WALL
- STORM SEWER
- WATERMAIN
- SANITARY SEWER
- SANITARY SERVICE
- WETLAND AREA
- EXISTING TREES
- GRAVEL ROAD

ARV	AIR RELEASE VALVE
CP	CATHODIC PROTECTION
STA	STATION
MUE	MULTI USE EASEMENT
APRX	APPROXIMATE
PR	PROPOSED
FT	FEET
DIA	DIAMETER
LF	LINEAL FEET
EL	ELEVATION

EROSION CONTROL LEGEND

SYMBOLS, ABBREVIATIONS, AND LINETYPES LEGEND

- CWA CONCRETE WASHOUT AREA
- CF CONSTRUCTION FENCE
- IP INLET PROTECTION
- OP OUTLET PROTECTION
- SF SILT FENCE
- VTC/SSA VEHICLE TRACKING CONTROL/ STABILIZED STAGING AREA
- LOC LIMITS OF CONSTRUCTION
- CD CHECK DAM
- SM SEEDING AND MULCHING
- SB SEDIMENT BASIN
- SR SURFACE ROUGHENING
- ECB EROSION CONTROL BLANKET
- CIP CULVERT INLET PROTECTION
- RS ROCK SOCK
- GR

BAR IS ONE INCH ON OFFICIAL DRAWINGS.
0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

HR GREEN - DENVER
5613 DTC PARKWAY | SUITE 950
GREENWOOD VILLAGE, CO 80111
PHONE: 720.602.4999
FAX: 844.273.1057

DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

PRELIMINARY PLANS
LEGEND AND ABBREVIATIONS

SHEET
G.002

02

UTILITY NOTES

1. CONTRACTOR TO OBTAIN WORK IN THE ROW PERMIT FROM GILPIN COUNTY PRIOR TO CONSTRUCTION.
2. CONTRACTOR TO POTHOLE AND VERIFY EXISTENCE OF OTHER UTILITIES WITHIN ANY PUBLIC RIGHT OF WAYS.
3. CONTRACTOR TO MAINTAIN 5.5' MINIMUM COVER ALL OVER WATER MAINS CONSTRUCTED.
4. ALL VALVES SHOWN FOR SCHEMATIC PURPOSES ONLY. NO VALVES SHALL BE INSTALLED IN CURB AND GUTTER OR CROSS PANS.
5. STANDARD WATER SERVICES LOCATIONS TO BE 10' FROM THE DOWNSTREAM PROPERTY LINE AND EXTENDED 10' TO THE UTILITY EASEMENT.
6. STANDARD WASTEWATER SERVICES TO BE IN A COMMON TRENCH WITH STANDARD WATER SERVICES. SHALL BE LOCATION A MINIMUM OF 30" FROM CENTER OF PIPE. STANDARD SERVICES SHALL BE MARKED WITH 2"X4" POST AT TERMINATION POINT FOR LOCATION DURING CONNECTION TO RESIDENCE. POSTS SHALL BE SPRAY–PAINTED BLUE FOR WATER AND GREEN FOR SEWER.
7. CURB STOPS ARE NOT TO BE INSTALLED IN CONCRETE CURB, CROSS PANS, SIDEWALKS, OR DRIVEWAYS.
8. SEE PLANS FOR THE LOCATION OF STANDARD SERVICES ON CORNER LOTS.

CAUTION - NOTICE TO CONTRACTOR

1. ALL UTILITY LOCATIONS SHOWN ARE BASED ON MAPS PROVIDED BY THE APPROPRIATE UTILITY COMPANY AND FIELD SURFACE EVIDENCE AT THE TIME OF SURVEY AND IS TO BE CONSIDERED AN APPROXIMATE LOCATION ONLY. IT IS THE CONTRACTORS RESPONSIBILITY TO FIELD VERIFY THE LOCATION OF ALL UTILITIES, PUBLIC OR PRIVATE, WHETHER SHOWN ON THE PLANS OR NOT, PRIOR TO CONSTRUCTION. REPORT ANY DISCREPANCIES TO THE ENGINEER PRIOR TO CONSTRUCTION.
2. WHERE A PROPOSED UTILITY CROSSES AN EXISTING UTILITY, IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF SUCH EXISTING UTILITY, EITHER THROUGH POTHOLING OR ALTERNATIVE METHOD. REPORT INFORMATION TO THE ENGINEER PRIOR TO CONSTRUCTION.
3. CONTRACTOR SHALL PROTECT ALL EXISTING SURVEY MONUMENTATION. CONTRACTOR SHALL HAVE LICENSED SURVEYOR REPLACE ANY DAMAGED OR DISTURBED MONUMENTATION AT THEIR COST.
4. CONTRACTOR MUST COORDINATE WORK WITH UTILITY COMPANY AND CITY PRIOR TO BEGINNING WORK AND IS RESPONSIBLE FOR ALL MATERIALS, LABOR, REPAIRS, ECT. TO COMPLETE WORK AND RESTORE AREA TO SAME STATE PRIOR TO STARTING WORK.
5. CONTRACTOR RESPONSIBLE FOR AS–BUILT DRAWINGS, TESTS, REPORTS, AND/OR ANY OTHER CERTIFICATES OR INFORMATION AS REQUIRED FOR ACCEPTANCE OF WORK FROM CITY, UTILITY DISTRICTS OR ANY OTHER GOVERNING AGENCY.
6. SURVEYOR TO OBTAIN AUTOCAD FILE FROM ENGINEER AND VERIFY ALL HORIZONTAL CONTROL DIMENSIONING PRIOR TO CONSTRUCTION STAKING. SURVEYOR MUST VERIFY ALL BENCHMARK, BASIS OF BEARING AND DATUM INFORMATION TO ENSURE IMPROVEMENTS WILL BE AT THE SAME HORIZONTAL AND VERTICAL LOCATIONS SHOWN ON THE DESIGN CONSTRUCTION DRAWINGS. PRIOR TO CONSTRUCTION STAKING ANY DISCREPANCY MUST BE REPORTED TO OWNER AND ENGINEER PRIOR TO CONTINUATION OF ANY FURTHER STAKING OR CONSTRUCTION WORK.
7.

GRADING AND EROSION CONTROL NOTES

1. ALL GRADING, EROSION, AND SEDIMENT CONTROL MUST CONFORM TO APPROVED PLANS. REVISIONS TO LAND DISTURBANCE AREAS, SLOPES, AND/OR EROSION AND SEDIMENT CONTROL MEASURES ARE NOT PERMITTED WITHOUT PRIOR APPROVAL FROM THE ENGINEER. FIELD MODIFICATIONS TO AN EQUIVALENT BMP THAT DOES NOT AFFECT THE SITE HYDROLOGY MAY BE APPROVED BY JEFFERSON COUNTY TRANSPORTATION AND ENGINEERING STAFF.
2. THE LANDOWNER AND/OR CONTRACTOR IS RESPONSIBLE FOR OBTAINING A PERMIT FOR STORMWATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY FROM THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, AT LEAST 10 DAYS PRIOR THE START OF CONSTRUCTION ACTIVITIES FOR LAND DISTURBANCE AREAS OF ONE ACRE PR GREATER. THE PERMIT MUST BE KEPT CURRENT THROUGHOUT THE CONSTRUCTION PROCESS.
3. EROSION CONTROL BMPS MUST BE INSTALLED PRIOR TO GRADING ACTIVITIES.
4. APPROVED EROSION AND SEDIMENT CONTROL BMPS SHALL BE MAINTAINED AND KEPT IN GOOD REPAIR FOR THE DURATION OF THE PROJECT. AT A MINIMUM, THE PROPERTY OWNER OR CONTRACTOR SHALL INSPECT ALL BMPS IN ACCORDANCE WITH THE APPROVED PLANS. ALL NECESSARY MAINTENANCE AND REPAIR ACTIVITIES SHALL BE COMPLETED IMMEDIATELY. ACCUMULATE SEDIMENT AND CONSTRUCTION DEBRIS SHALL BE REMOVED AND PROPERLY DISPOSED.
5. ALL TOPSOIL MUST BE SALVAGED, SEGREGATED, AND STOCKPILED SEPARATELY FROM THE OVERBURDEN. TOPSOIL AND OVERBURDEN MUST BE REDISTRIBUTED WITHIN THE GRADED AREA AFTER ROUGH GRADING TO PROVIDE A SUITABLE BASE FOR AREAS THAT MUST BE SEEDED AND PLANTED. RUNOFF FROM THE STOCKPILED AREA MUST BE CONTROLLED TO PREVENT EROSION AND SEDIMENTATION OF RECEIVING WATERS.
6. SOILS THAT ARE STOCKPILED FOR MORE THAN THIRTY (30) DAYS SHALL BE SEEDED AND MULCHED WITHIN FOURTEEN (14) DAYS OF STOCKPILE CONSTRUCTION.
7. THE LANDOWNER AND/OR CONTRACTOR MUST IMMEDIATELY TAKE ALL NECESSARY STEPS TO CONTROL SEDIMENT DISCHARGE.
8. SOIL STABILIZATION MEASURES SHALL BE APPLIED WITHIN 30 DAYS TO DISTURBED AREAS, WHICH MAY NOT BE AT FINAL GRADE, BUT WILL BE LEFT DORMANT FOR LONGER THAN 60 DAYS.
9. ALL DISTURBED SLOPES (UNLESS IN A COMPETENT ROCK CUT) GREATER THAN OR EQUAL TO 3:1 (H:V), FLOW LINES OF SWALES, GUTTER DOWNSPOUTS, OR ADDITIONAL AREAS AT THE DISCRETION OF COUNTY STAFF, SHALL BE PROTECTED WITH AN EROSION CONTROL BLANKET OR EQUIVALENT BMP...
10. THE CONTRACTOR IS RESPONSIBLE FOR CLEAN UP AND REMOVAL OF ALL SEDIMENT AND DEBRIS FROM ALL DRAINAGE INFRASTRUCTURE AND PUBLIC FACILITIES DURING THE ENTIRE CONSTRUCTION PROCESS.
11. THE CONTRACTOR IS RESPONSIBLE FOR CONTROLLING LITTER SUCH AS DISCARDED BUILDING MATERIALS, CONCRETE TRUCK WASHOUT, CHEMICALS, AND SANITARY WASTE, AS APPLICABLE. IN ADDITION, SPILL PREVENTION AND CONTAINMENT BMPS FOR CONSTRUCTION CONCRETE WASHOUT AREAS, AND TRASH RECEPTACLES MUST BE CLEARLY SHOWN ON THE PLANS.LITTERING IS DEFINED AND ENFORCED BY CRS 18–4–511.
12. FUGITIVE DUST EMISSIONS RESULTING FROM GRADING ACTIVITIES AND/OR WIND SHALL BE CONTROLLED USING THE BEST AVAILABLE CONTROL TECHNOLOGY, AS DEFINED BY THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, AT THE TIME OF GRADING.
13. EARTH MATERIALS AND CONSTRUCTION SUPPLIES ARE TO BE STORED ON A CONSTRUCTION SITE STAGING AREA, AND ARE NOT TO BE STORED ON THE STREET OR SIDEWALK, LOCATION OF STOCKPILES, CONCRETE WASHOUT AREAS AND TRASH RECEPTACLES ARE LOCATED ON THE PLANS.

BAR IS ONE INCH ON OFFICIAL DRAWINGS.
0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

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DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

PRELIMINARY PLANS
GENERAL NOTES

SHEET
G.003

03

HORIZONTAL CONTROL INFORMATION				
CONTROL POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
50	188341.34	8515.25	8963.29	NO.5 REBAR WITH 2-1/2" ALUMINUM CAP STAMPED "AZTEC CP 50"
51	187588.42	8780.16	8959.81	NO.5 REBAR WITH 2-1/2" ALUMINUM CAP STAMPED "AZTEC CP 51"
52	188256.63	9273.81	8999.73	NO.5 REBAR WITH 2-1/2" ALUMINUM CAP STAMPED "AZTEC CP 52"

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DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

PRELIMINARY PLANS
SURVEY CONTROL

SHEET
G.004

04

DORY LAKES SUBDIVISION FILING NO. 3

EXISTING SUBMERGED PUMPS ON SKID (PARTIALLY BURIED)

1

EXISTING 6" HDPE AND ELECTRICAL CONDUIT

APPROXIMATE HIGH WATER LEVEL

8955

8960

5' UTILITY ESMT.

2

20' GENERAL ESMT.

5' UTILITY ESMT.

20' GENERAL ESMT.

5' UTILITY ESMT.

4

N: 187871.61
E: 8756.56

EXISTING TRAIL

PROVIDE "TRAIL CLOSED" SIGNAGE/BARRICADES ON THE TRAIL DURINGWORKING HOURS

EXISTING TRAIL

PROVIDE "TRAIL CLOSED" SIGNAGE/BARRICADES ON THE TRAIL DURINGWORKING HOURS

LOT 13

LOT 12

5' UTILITY ESMT.

3

5' UTILITY ESMT.

EXISTING DISCHARGE PIPE AND ELECTRICAL CONDUIT

EXISTING TRAIL

EXISTING ELECTRICAL VAULT

20' GENERAL ESMT.

EXISTING PEDESTRIAN BRIDGE PROTECT IN PLACE

EXISTING DRAINAGE DITCH

LOT 11

LOT 10

5' UTILITY ESMT.

10' ELECTRIC POWER LINE ESMT.

PROVIDE "TRAIL CLOSED" SIGNAGE/BARRICADES ON THE TRAIL DURING WORKING HOURS

10' ELECTRIC POWER LINE ESMT.

N DORY LAKES DRIVE
(50' WIDE PUBLIC ROW)

STAGING AREA

NORTH

KEY NOTES:

1. REMOVE EXISTING PUMP SKID AND ALL APPURTENANCES AT THE BOTTOM OF THE LAKE
2. REMOVE EXISTING 6 IN HDPE PIPE AND ELECTRICAL CONDUIT UP TO PROPOSED PUMP STATION VAULT. A TEMPORARY CAP SHOULD BE PLACED OVER THE CONNECTION INTO THE PROPOSED PUMP STATION VAULT UNTIL NEW PIPE IS INSTALLED.
3. EXISTING PEDESTAL TO BE REMOVED (REFER TO SHEET E.002).
4. CUT AND CAP EXISTING 6" HDPE AND ELECTRICAL CONDUIT.

GENERAL NOTES:

1. ALL EXISTING ITEMS SHOWN FOR DEMOLITION SHALL BE FIELD VERIFIED AND LOCATED
2. CONTRACTOR SHOULD SUBMIT A SEQUENCING PLAN FOR SITE DEMOLITION INCLUDING ANTICIPATED OUTAGES FOR ENGINEER AND OWNER PRIOR TO CONSTRUCTION. CONTRACTOR SHALL COORDINATE WITH OWNER MINIMUM 2 WEEKS PRIOR TO REMOVAL.

DRAWN BY:	BDB	JOB DATE:	8/6/2024
APPROVED:	GLP	JOB NUMBER:	2202658
CAD DATE:	8/6/2024		
CAD FILE:	J:\2022\2202658\CAD\Dwg\C\Civil		

BAR IS ONE INCH ON OFFICIAL DRAWINGS.
0 1"
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DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

CIVIL
EXISTING CONDITIONS AND SITE REMOVAL

GENERAL NOTES:

1. REFER TO C.001 FOR DEMOLITION ITEMS.
2. THIS SHEETS IS INTENDED TO SHOW OVERALL SITE LAYOUT, STAGING, AND TEMPORARY FACILITIES. REFER TO REMAINING C-SHEETS FOR DETAILED INFORMATION
3. SEE OUTLINED STAGING AREA ON SHEET C.005. CONTRACTOR TO COORDINATE WITH OWNER ON ANY ADDITIONAL STAGING AREAS.
4. CONSTRUCTION HOURS WILL BE M-F 9AM-5PM FOR CONSIDERATION OF NOISE AND ACTIVITY OF NEARBY PROPERTY OWNERS.
5. ANY AREA THAT IS A WORK SITE AND NOT COMPLETE FOR PUBLIC ACCESS SHALL BE BLOCKED OFF WITH TEMPORARY FENCING AND APPROPRIATE SIGNAGE ON "DETOUR" TO ACCESS THE LAKE FROM OTHER AREAS. EXISTING TRAIL SHALL BE ACCESSIBLE TO THE PUBLIC OUTSIDE CONSTRUCTION HOURS.
6. IN CASE OF CALL FOR WATER FROM XX FIRE DEPT, A TEMPORARY TRASH PUMP SHOULD BE PLACED ONSITE AND HOOKED INTO THE LINE IN VAULT ON DORY LAKE DR. FOR FIRE FLOW.

DORY LAKES SUBDIVISION FILING NO. 3

STA 2+47.98
PROPOSED PIPE INTAKE
N: 188058.25
E: 8750.27

STA 2+45.27
PROPOSED PIPE ANCHOR
N: 188055.59
E: 8750.73

APPROXIMATE HIGH WATER LEVEL

STA 1+95.27
PROPOSED PIPE ANCHOR
N: 188006.31
E: 8759.18

5' UTILITY ESMT

PROPOSED 6" HDPE

STA 1+45.27
PROPOSED PIPE ANCHOR
N: 187956.94
E: 8766.00

20' GENERAL ESMT.

5' UTILITY ESMT.

20' GENERAL ESMT.

5' UTILITY ESMT.

LOT 13

EXISTING TRAIL

STA 0+92.48
PROPOSED PIPE ANCHOR
N: 187904.26
E: 8762.60

PROVIDE "TRAIL CLOSED" SIGNAGE/BARRICADES ON THE TRAIL DURINGWORKING HOURS

PROPOSED PUMP STATION

EXISTING TRAIL

PROVIDE "TRAIL CLOSED" SIGNAGE/BARRICADES ON THE TRAIL DURINGWORKING HOURS

5' UTILITY ESMT.

LOT 12

LOT 10

5' UTILITY ESMT.

EXISTING DISCHARGE PIPE AND ELECTRICAL CONDUIT

5' UTILITY ESMT.

EXISTING TRAIL

EXISTING ELECTRICAL VAULT

20' GENERAL ESMT.

EXISTING PEDESTRIAN BRIDGE PROTECT IN PLACE

EXISTING DRAINAGE DITCH

LOT 11

10' ELECTRIC POWER LINE ESMT.

PROVIDE "TRAIL CLOSED" SIGNAGE/BARRICADES ON THE TRAIL DURING WORKING HOURS

10' ELECTRIC POWER LINE ESMT.

N DORY LAKES DRIVE
(50' WIDE PUBLIC ROW)

STAGING AREA

NORTH

DRAWN BY:	BDB	JOB DATE:	8/6/2024
APPROVED:	GJP	JOB NUMBER:	2202658
CAD DATE:	8/6/2024		
CAD FILE:	J:\2022\2202658\CAD\Dwg\C\Civil		

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DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

CIVIL
OVERALL SITE PLAN

N: 187904.26
E: 8762.60

EXISTING TRAIL

PROVIDE "TRAIL CLOSED" SIGNAGE/BARRICADES ON THE TRAIL DURING WORK HOURS

6" - 90° ELBOW

6" CARBON STEEL

6" - 90° ELBOW

6" - 90° ELBOW

6" - 90° ELBOW

6" X 4" REDUCER

ROCK SOCK

PROPOSED PUMP STATION

1

2

3

4

PROVIDE "TRAIL CLOSED" SIGNAGE/BARRICADES ON THE TRAIL DURING WORK HOURS

CONNECT INTO EXISTING 4-IN PVC PIPE

EXISTING TRAIL

APPROXIMATE LOCATION OF 4" DISCHARGE PIPE

CONSTRUCTION FENCE

NORTH

HR GREEN Xrefs: XV-Dsgn: XV-Environmental-Areas, XV-Landscape, XV-Util: agt-1-dt01-Dory_Utility_Notes, Key & General_Notes, XC-ALGN: XC-Dsgn: XC-Strm: XC-Aerial 1, XC-Watr: Dory Lake - PRST16199 R3 - 03.27.2024- XC-LOT-LINES, LT 11 & LT 12 DORY LAKES

DRAWN BY:	BDB
APPROVED:	GLP
CAD DATE:	8/6/2024
CAD FILE:	J:\2022\2202658\CAD\Dwg\C\Civil
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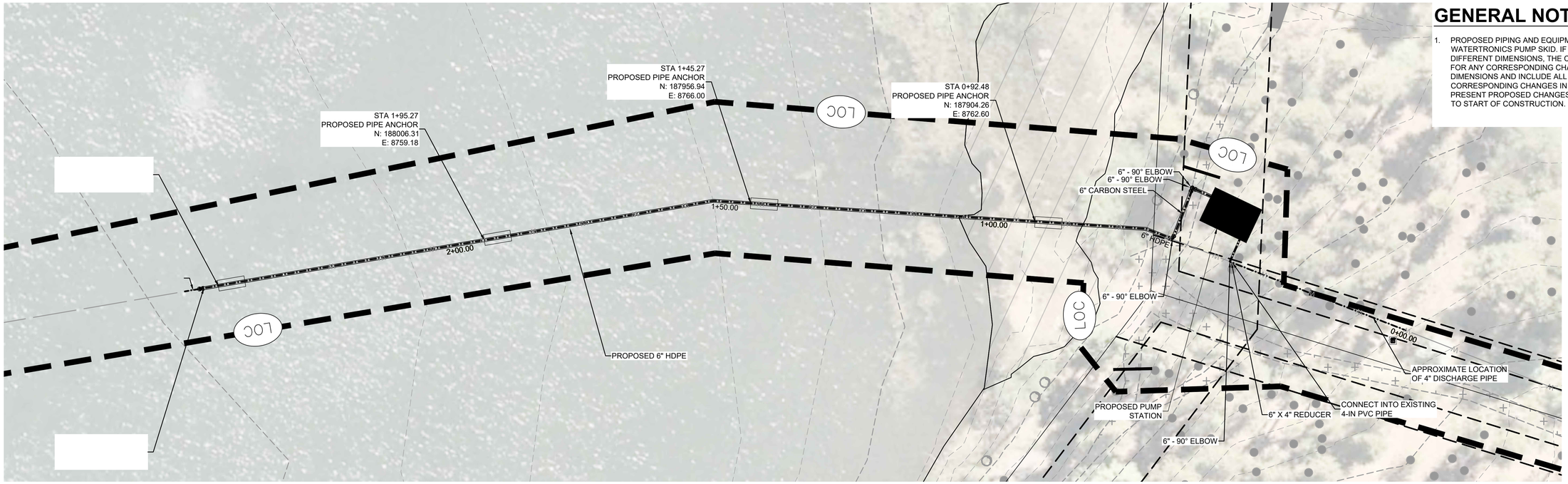
DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

CIVIL

PUMP STATION SITE PLAN



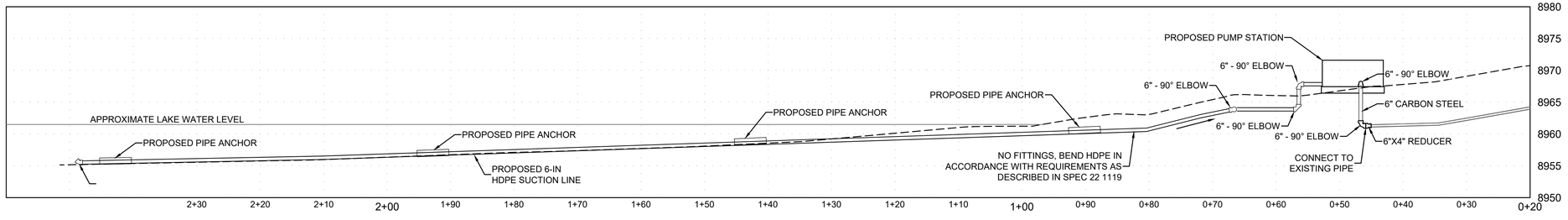
GENERAL NOTES:

1. PROPOSED PIPING AND EQUIPMENT LAYOUT IS BASED ON WATERTRONICS PUMP SKID. IF ANOTHER SKID IS SELECTED WITH DIFFERENT DIMENSIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY CORRESPONDING CHANGES AS A RESULT OF THE CHANGED DIMENSIONS AND INCLUDE ALL NECESSARY COSTS FOR THE CORRESPONDING CHANGES IN THEIR BID. CONTRACTOR SHALL PRESENT PROPOSED CHANGES TO ENGINEER FOR APPROVAL PRIOR TO START OF CONSTRUCTION.

NORTH

0 60

30



GENERAL NOTES:

1. EXISTING 4-IN WATER LINE IS APPROXIMATELY 6 FEET DEEP, BUT MAY BE MORE SHALLOW IN HEAVY BEDROCK CONDITIONS. CONTRACTOR TO VERIFY LOCATION AND DEPTH OF EXISTING WATER PIPE BEFORE INSTALLATION SKID AND CONNECTION TO PIPE.
2. CONNECT INTO EXISTING PIPE WITH PVC PIPE WITH FLANGED RETAINER ADAPTER.
3. DETAILS OF PUMP SKID AND SUCTION INTAKE SCREEN ARE SHOWN ON PAGE C.500.
4. INSTALL ½ OF A 24" RCP, 4-FEET IN LENGTH, DOG HOUSE STYLE PIPE ANCHOR, OR APPROVED ALTERNATE. ANCHOR SHALL BE A MINIMUM OF 400 POUNDS.

NORTH

0 10

05

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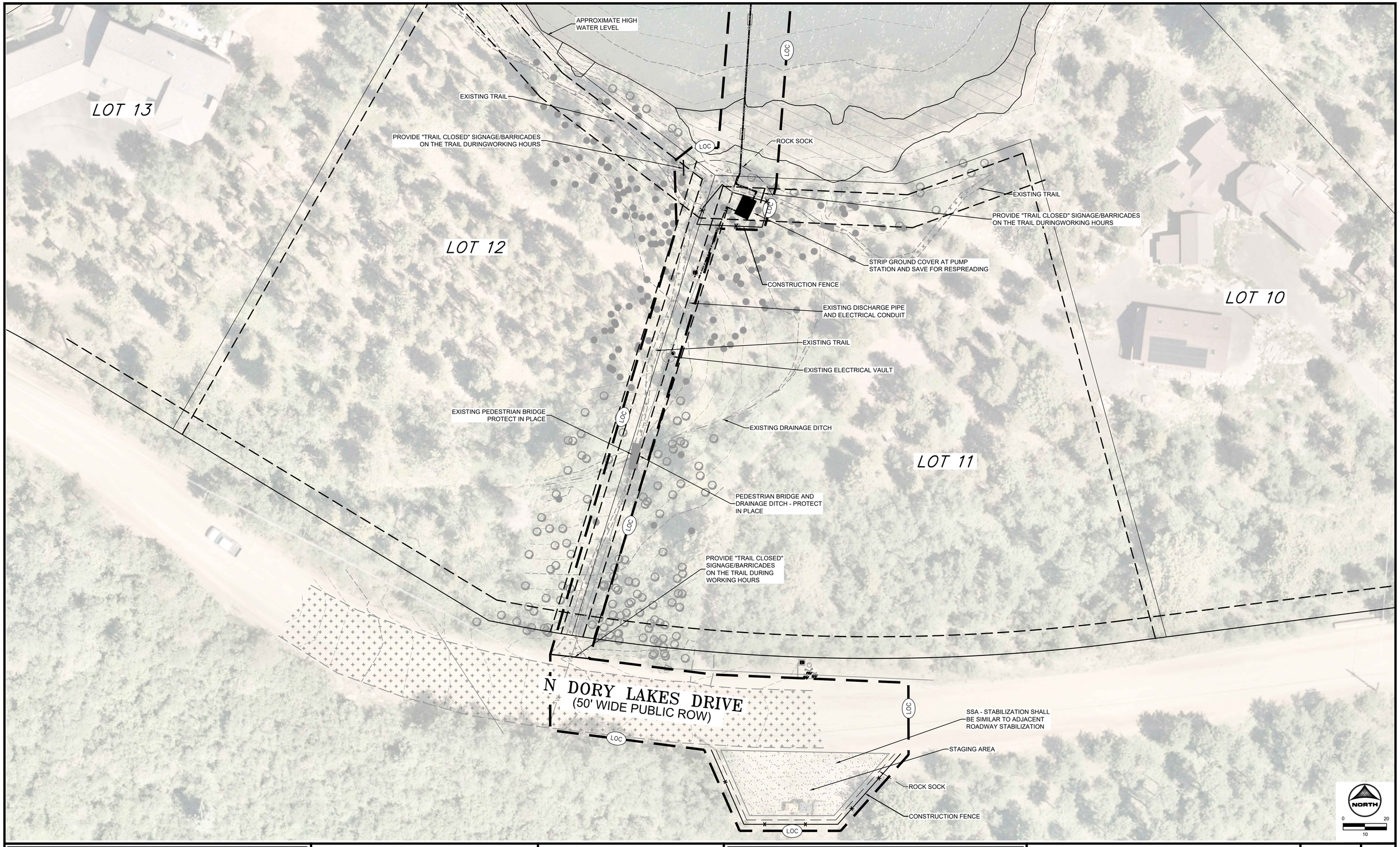
DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

CIVIL
PIPE PLAN AND PROFILE

SHEET
C.004

08



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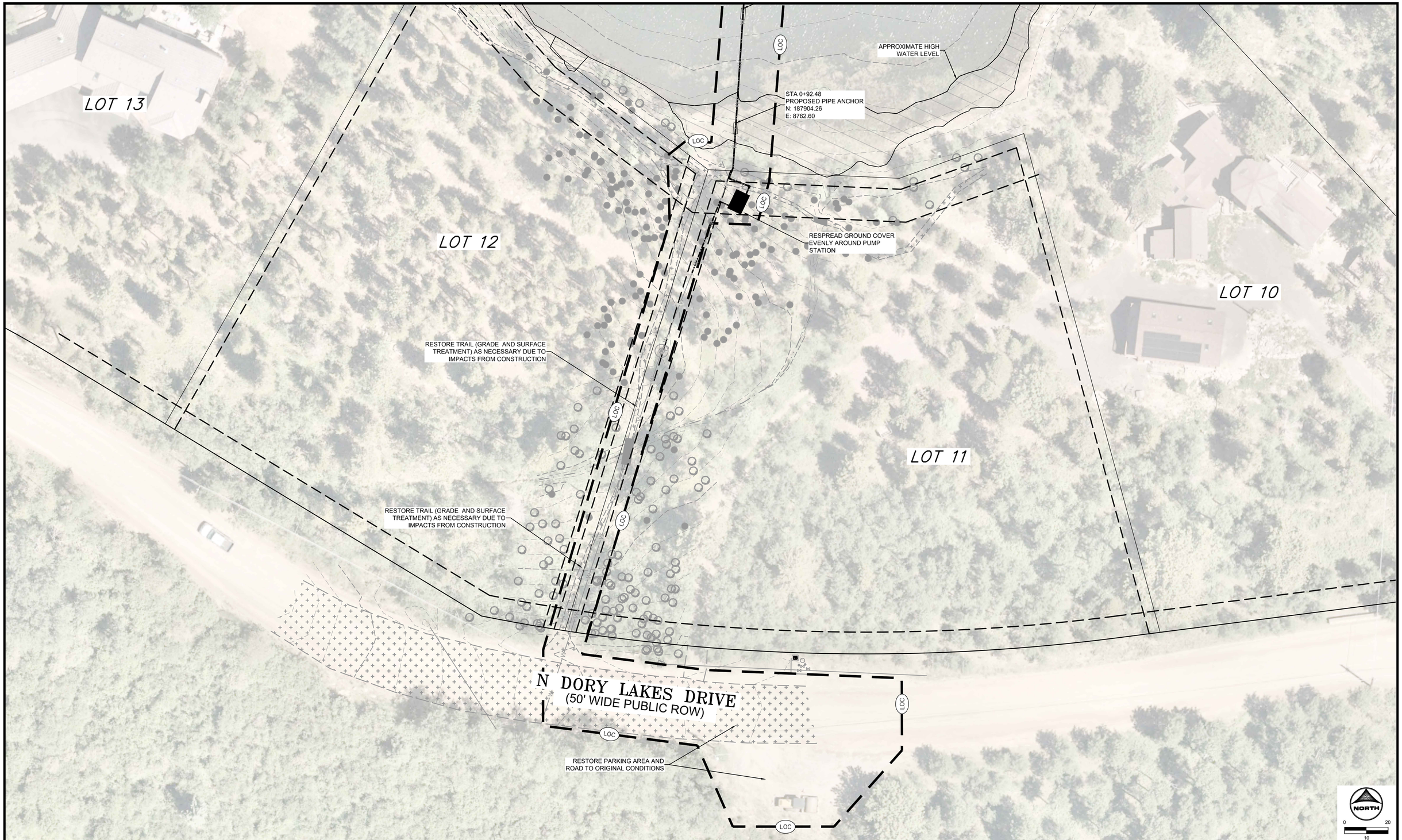
DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

CIVIL
INITIAL EROSION CONTROL

SHEET
C.005

09



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DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

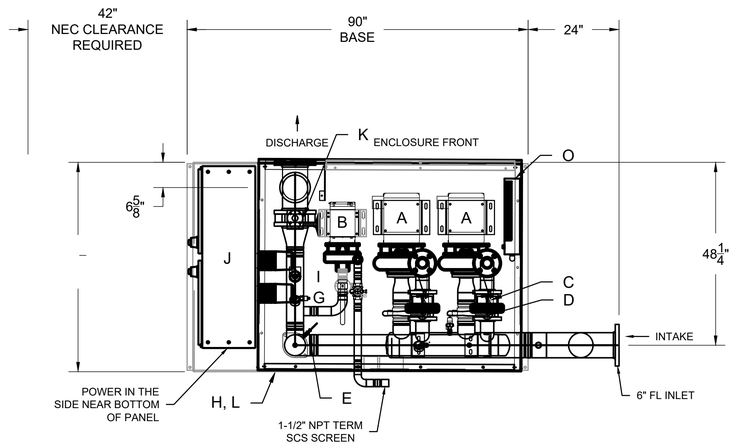
CIVIL
FINAL EROSION CONTROL

SHEET
C.006

10

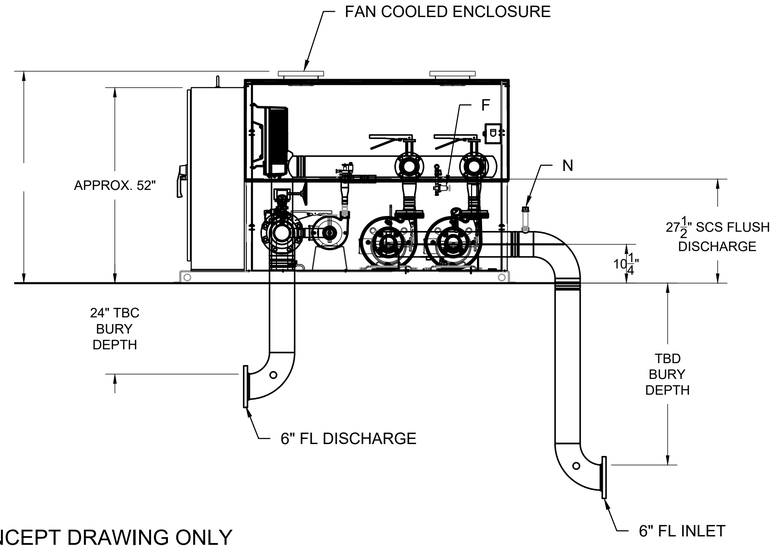
GENERAL NOTES:

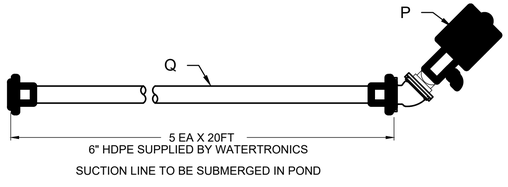
1. PROPOSED PIPING AND EQUIPMENT LAYOUT IS BASED ON WATERTRONICS PUMP SKID. IF ANOTHER SKID IS SELECTED WITH DIFFERENT DIMENSIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY CORRESPONDING CHANGES AS A RESULT OF THE CHANGED DIMENSIONS AND INCLUDE ALL NECESSARY COSTS FOR THE CORRESPONDING CHANGES IN THEIR BIB. CONTRACTOR SHALL PRESENT PROPOSED CHANGES TO ENGINEER FOR APPROVAL PRIOR TO START OF CONSTRUCTION.



NOTE:
42" NEC CLEARANCE IS REQUIRED IN FRONT OF THE ELECTRICAL CABINET.

STATION COMPONENTS:
A 5 HP PUMP AND MOTOR
B 1.5 HP PUMP AND MOTOR
C CHECK VALVE
D PUMP ISOLATION VALVE
E DRAIN
F POSITIVE PRIME
G PRESSURE TRANSDUCER W/ GAUGE
H PAINTED STEEL BASE (SANDSTONE)
I FLOW SENSOR
J CONTROL CABINET (DEAD FRONT)
K 6" STATION DISCHARGE ISOLATION VALVE
L PAINTED STEEL ENCLOSURE (SANDSTONE
M TEMPERATURE SENSOR
N FILL PORT
O 500W HEATER
P 6" SELF CLEANING INLET SCREEN
W/ MUD PLATE
Q 6" FL X 6" FL HDPE SUCTION PIPE





SUCTION LINE TO BE SUBMERGED IN POND

CONCEPT DRAWING ONLY
NOT TO BE USED FOR CONSTRUCTION

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DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

CIVIL
CIVIL DETAILS

SHEET
C.500

11

acking Control (VTC)

NOTES

),
WITH/WITHOUT WHEEL WASH,

ON ENTRANCES ARE ONLY TO BE
ING FROM A WEEK TO A MONTH)

BE LOCATED AT ALL ACCESS POINTS
M PAVED RIGHT-OF-WAYS.

INSTALLED PRIOR TO ANY LAND

D UNDER THE STABILIZED
NT OF ROCK.

N, ROCK SHALL CONSIST OF DOT
INUS) ROCK.

NOTES

IN EFFECTIVE OPERATING CONDITION.
CTIVE. INSPECT BMPs AS SOON AS
A STORM THAT CAUSES SURFACE

CESSARY TO MAINTAIN BMPs IN
RRECTIVE MEASURES SHOULD BE

F SHOULD BE INITIATED UPON

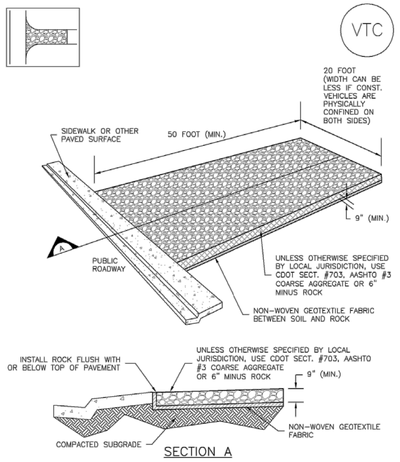
SSARY TO THE STABILIZED

EMOVED THROUGHOUT THE DAY AND
SEDIMENT MAY NOT BE WASHED

RY FROM UDFCD STANDARD DETAILS.
AIL SHOULD BE USED WHEN

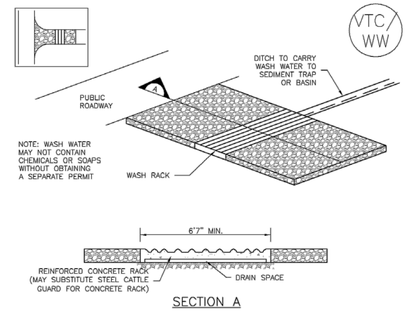
IN AUTOCAD)

Vehicle Tracking Control (VTC) SM-4



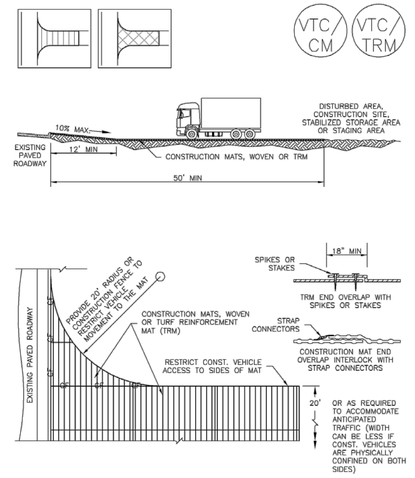
VTC-1. AGGREGATE VEHICLE TRACKING CONTROL

SM-4 Vehicle Tracking Control (VTC)



VTC-2. AGGREGATE VEHICLE TRACKING CONTROL WITH WASH RACK

Vehicle Tracking Control (VTC) SM-4



VTC-3. VEHICLE TRACKING CONTROL W/ CONSTRUCTION MAT OR TURF REINFORCEMENT MAT (TRM)

SM-6

SSA

NSTRUCTION
AILERS

- 3" MIN. THICKNESS
GRANULAR MATERIAL

- SILT FENCE OR CONSTRUCTION
FENCING AS NEEDED

E AREA

ING AREA WITH APPROVAL

HE NEEDS OF THE SITE.
WING CONSTRUCTION.

RATIONS ON THE SITE.

UM 3" THICK GRANULAR

CK SHALL CONSIST OF DOT
ROCK.

BUT NOT LIMITED TO SILT

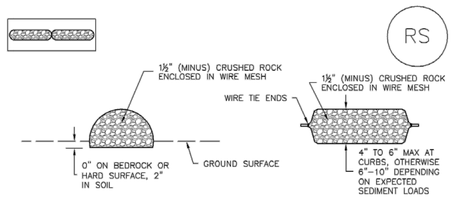
FECTIVE OPERATING CONDITION.
. INSPECT BMPs AS SOON AS
RM THAT CAUSES SURFACE

RY TO MAINTAIN BMPs IN
VE MEASURES SHOULD BE

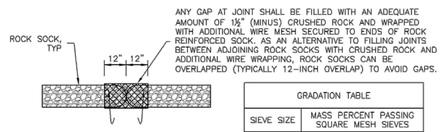
ULD BE INITIATED UPON

IF RUTTING OCCURS OR

SC-5 Rock Sock (RS)



ROCK SOCK SECTION ROCK SOCK PLAN



ROCK SOCK JOINTING

ANY GAP AT JOINT SHALL BE FILLED WITH AN ADEQUATE AMOUNT OF 1½" (MINUS) CRUSHED ROCK AND WRAPPED WITH ADDITIONAL WIRE MESH SECURED TO ENDS OF ROCK REINFORCED SOCK. AS AN ALTERNATIVE TO FILLING JOINTS BETWEEN ADJOINING ROCK SOCKS WITH CRUSHED ROCK AND ADDITIONAL WIRE WRAPPING, ROCK SOCKS CAN BE OVERLAPPED (TYPICALLY 12-INCH OVERLAP) TO AVOID GAPS.

GRADATION TABLE	
SIEVE SIZE	MASS PERCENT PASSING SQUARE MESH SIEVES
	NO. 4
2"	100
1½"	90 – 100
1"	20 – 55
¾"	0 – 15
⅜"	0 – 5
MATCHES SPECIFICATIONS FOR NO. 4 COARSE AGGREGATE FOR CONCRETE PER AASHTO M43. ALL ROCK SHALL BE FRACTURED FACE, ALL SIDES.	

ROCK SOCK INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
-LOCATION(S) OF ROCK SOCKS.

2. CRUSHED ROCK SHALL BE 1½" (MINUS) IN SIZE WITH A FRACTURED FACE (ALL SIDES) AND SHALL COMPLY WITH GRADATION SHOWN ON THIS SHEET (1½" MINUS).

3. WIRE MESH SHALL BE FABRICATED OF 10 GAGE POULTRY MESH, OR EQUIVALENT, WITH A MAXIMUM OPENING OF ½", RECOMMENDED MINIMUM ROLL WIDTH OF 48"

4. WIRE MESH SHALL BE SECURED USING "HOG RINGS" OR WIRE TIES AT 6" CENTERS ALONG ALL JOINTS AND AT 2' CENTERS ON ENDS OF SOCKS.

5. SOME MUNICIPALITIES MAY ALLOW THE USE OF FILTER FABRIC AS AN ALTERNATIVE TO WIRE MESH FOR THE ROCK ENCLOSURE.

RS-1. ROCK SOCK PERIMETER CONTROL

BAR IS ONE INCH ON OFFICIAL DRAWINGS.
0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

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REINFORCING LAP SPLICE TABLE - 4,000 PSI CONCRETE (MIN)						
			CONDITION 2		CONDITION 3	HOOKS
			CLEAR COVER >= 1 DIA C-TO-C SPACING >= 3 DIA			STD 90 DEGREE HOOK LENGTH
				OTHER	ALL BARS	
				1' - 6"	SEE NOTE 3	0' - 6"
				2' - 1"		0' - 8"
				2' - 8"		0' - 10"
				3' - 1"		1' - 0"
				4' - 7"		1' - 2"
				5' - 2"		1' - 4"
				5' - 10"		1' - 7"
				6' - 6"		1' - 10"
				7' - 4"		2' - 0"

LAP ALL BARS PER THIS SCHEDULE UNLESS NOTED OTHERWISE.
BAR COVER AND SPACING MUST BOTH MEET THE CRITERIA OF CONDITION 1 OR 2 IN

TOP BARS SHALL BE DEFINED AS ANY HORIZONTAL BARS PLACED SUCH THAT MORE THAN 12" OF FRESH CONCRETE IS CAST IN THE MEMBER BELOW THE BAR IN ANY SINGLE POUR. HORIZONTAL WALL BARS ARE CONSIDERED TOP BARS.
FOR BARS THAT DO NOT SATISFY EITHER CONDITION, LAP LENGTH SHALL BE THE LENGTH FROM THE APPROPRIATE CATEGORY ("TOP" OR "OTHER") OF CONDITION 2

FOR EPOXY-COATED BARS, MULTIPLY FINAL LAP LENGTH BY 1.5.
NON-CONTACT LAP SPLICE LENGTH IS THE LAP SPLICE PLUS THE SEPARATION OF BARS BEING LAPPED. BARS BEING LAPPED CANNOT BE FURTHER APART THAN 1/5TH OF THE LAP SPLICE LENGTH OR 6 INCHED, WHICHEVER IS SMALLER.
CLEAR COVER IS DISTANCE FROM FACE OF CONCRETE TO FACE OF BAR.

1 CONCRETE REINFORCING LAP SPICE TAPLE

CONCRETE MATERIAL SCHEDULE	
PROPERTIES/MATERIALS \ PROJECT USE	MIX 1 ENVIRONMENTAL STRUCTURES
COMPRESSIVE STRENGTH - MINIMUM	4,500 psi
PORTLAND CEMENT - ASTM C595	1L OR 2L
FLYASH - ASTM C618	NOT PERMITTED
AGGREGATE - COARSE - ASTM C33	1" MAX
AIR ENTRAINMENT - ASTM C260	6% ± 1%
SUPER PLASTICIZER - ASTM C494	(OPTIONAL) TYPE F
WATER TO CEMENT RATIO - MAXIMUM	0.42 MAX
SYNTHETIC FIBERS	FLATWORK AND TOPPING SLABS
SLUMP	3" ± 1"
WATERPROOFING	NOT REQUIRED

DETAIL NOTES

1. ALL CONCRETE IS MIX 1 UNLESS NOTED OTHERWISE.

2 CONCRETE MATERIAL SCHEDULE
SCALE: NONE

CONCRETE PROTECTION FOR REINFORCEMENT CONCRETE CLEAR COVER DIMENSIONS UNLESS NOTED OTHERWISE	
CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH OR "RAW" SEWAGE	3"
CONCRETE IN CONTACT WITH OR IMMEDIATELY ABOVE OR ADJACENT TO WATER/WASTEWATER	2"
CONCRETE EXPOSED TO EARTH OR WEATHER	
#6 THROUGH #11 BARS	2"
#5 AND SMALLER, W31 OR D31 WIRE	1 1/2"
CONCRETE NOT EXPOSED TO WEATHER, CONTACT WITH GROUND, OR WASTEWATER	
SLABS, WALLS, AND JOISTS: #11 AND LARGER BARS	1 1/2"
#10 AND SMALLER BARS	LARGER OF 1" OR BAR DIA.
BEAMS AND COLUMNS: PRIMARY REINFORCEMENT, TIES, STIRRUPS AND SPIRALS	1 1/2"

DETAIL NOTES

1. SEE SPECIFICATIONS OR GENERAL NOTES FOR TOLERANCES.
2. CLEAR COVER IS DISTANCE FROM FACE OF CONCRETE TO FACE OF BAR.

3 CONCRETE COVER REQUIREMENTS
SCALE: NONE

STANDARD CONCRETE ANCHORS						
ANCHOR DIAMETER	3/8"	1/2"	5/8"	3/4"	7/8"	1"
STANDARD MECHANICAL ANCHOR EMBED, UNO (NOTE 1)	3 1/4"	3 1/2"	4 1/2"	5 1/2"	N/A	N/A
STANDARD ADHESIVE ANCHOR EMBED, UNO (NOTE 1)	3 1/4"	4"	5"	6"	8"	10"
MINIMUM SPACING	4"	6"	8"	9"	12"	16"
MINIMUM EDGE DISTANCE	4"	4"	5"	8"	12"	16"
MINIMUM CONCRETE THICKNESS	5"	6"	8"	10"	12"	14"
ALLOWABLE TENSION "T" (LB) *	750*	1,100*	1,450*	2,350*	5,200*	7,800*
ALLOWABLE SHEAR "V" (LB) *	300*	400*	625*	1,150*	1,950*	3,250*

* LOADS ONLY APPLICABLE TO INSTALLATION INTO CRACKED CONCRETE 4,000 ≤ Fc' ≤ 8,000 PSI MEETING MINIMUM EMBED, SPACING, AND EDGE DISTANCES SHOWN. LOADS FOR SINGLE ANCHOR ,OUT OF THE GROUP BELOW, WITH SERVICE LEVEL (ASD) LOADING.

DETAIL NOTES

1. ALL ANCHORS SHALL RECEIVE STANDARD EMBED, SPACING, EDGE DISTANCE, CONCRETE THICKNESS, AND LOAD CONDITIONS, UNLESS NOTED OTHERWISE ON "S" SHEETS. UNLESS NOTED OTHERWISE, MINIMUM EMBEDMENT SHALL BE PER TABLE ABOVE. IN NO CASE MAY THE EMBEDMENT BE LESS THAN THE MANUFACTURERS "MINIMUM EMBEDMENT" FROM PUBLISHED CATALOG LITERATURE.
2. CONTRACTOR SHALL USE BASIS OF DESIGN ANCHORS OR SUBMIT ENGINEERED ANCHORS MEETING REQUIREMENTS OF ACI 355.2 & APPLICABLE TO EDGE AND SPACING REQUIREMENTS OF THE CONTRACT DOCUMENTS FOR APPROVAL. BASIS OF DESIGN ANCHORS INCLUDE:
   a. SCREW: HILTI KWIK-HUS EZ AND SIMPSON TITEN HD
   b. EXPANSION: HILTI KWIK BOLT 2
   c. ADHESIVE: HILTI HIT-RE 500 V3 & SIMPSON SET 3G WITH THREADED ROD

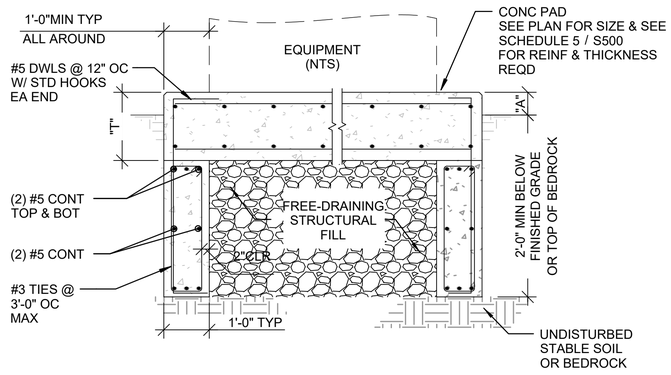
   WHERE DRAWINGS CALL FOR CONCRETE ANCHORS, CONTRACTOR MAY CHOOSE BETWEEN EXPANSION, SCREW OR ADHESIVE ANCHOR. WHERE DRAWINGS CALL FOR MECH ANCHOR, CONTRACTOR MAY CHOOSE BETWEEN EXPANSION AND SCREW ANCHOR.
3. INSTALL IN STRICT ACCORDANCE WITH MANUFACTURER'S PUBLISHED RECOMMENDATIONS AND ADDITIONAL RECOMMENDATIONS OF ICC EVALUATION SERVICE REPORT.
4. ALL CONCRETE ANCHORS MUST BE INSPECTED TWICE:
   a. AFTER HOLE IS DRILLED AND CLEANED, AND
   b. DURING INSTALLATION OF ADHESIVE AND/OR MECHANICAL ANCHOR.
5. ON DRAWINGS, ADHESIVE ANCHORS MAY ALSO BE REFERRED TO AS EPOXY OR EPOXY SET ANCHORS.
6. FOR ANCHORS RESISTING TENSION AND SHEAR USE FOLLOWING EQUATION: (ACTUAL TENSION/ALLOWABLE TENSION) + (ACTUAL SHEAR / ALLOWABLE SHEAR) <1.00
7. ADHESIVE ANCHORS MAY NOT BE USED IN OVERHEAD APPLICATIONS UNLESS NOTED OTHERWISE ON THE "S" SHEETS.
8. ANY ADHESIVE ANCHOR IN CONSTANT TENSION OR INSTALLED IN ANY ORIENTATION BETWEEN HORIZONTAL AND OVERHEAD (VERTICAL) MUST BE INSTALLED AND INSPECTED BY CERTIFIED INSTALLER / INSPECTOR. SEE DIVISION 5 SPECIFICATIONS.
9. ALL CONCRETE ANCHORS SHALL BE STAINLESS STEEL TYPE 316 UNO.
10. DO NOT INSTALL ADHESIVE ANCHORS IN CONCRETE LESS THAN 21 DAYS OLD.

4 CONCRETE ANCHOR SCHEDULE
SCALE: NONE

TYPICAL CONCRETE PAD REINFORCING SCHEDULE UNO		
		"A"
	#3@8" OC (CENTERED)	4"

1. CHAMFER EXPOSED CONCRETE CORNERS (3/4" TYP).
   EXCAVATE DOWN TO UNDISTURBED STABLE SOIL MEETING DESIGN BEARING PRESSURE CONSTRAINTS.
   COORDINATE ALL LOCATIONS OF PENETRATIONS IN SLAB AND WALL AS NEEDED FOR PIPING, CONDUIT, WIRING, AND CONTROLS.

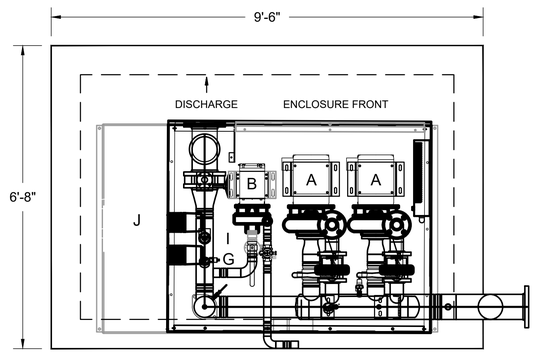
5 PAD REINFORCING SCHEDULE



DETAIL NOTES

1. REMOVE ALL ORGANIC TOPSOIL
2. EXCAVATE DOWN TO UNDISTURBED STABLE SOILS MEETING DESIGN BEARING PRESSURE CONSTRAINTS.
3. FILL WITH ONSITE INORGANIC MATERIAL SOILS OR NEW GRAINULAR FILL COMPACTED TO MIN. 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY.
4. CONCRETE SHALL BE MIX 1 UNO WITH LIGHT BROOM FINISH
5. COORDINATE ALL LOCATIONS OF PENETRATIONS IN SLAB AND WALL AS NEEDED FOR PIPING, CONDUIT, WIRING, AND CONTROLS.

6 EQUIPMENT WITH FROST FOUNDATION
SCALE: 1" = 20'



STATION COMPONENTS:

A	5 HP PUMP AND MOTOR
B	5 HP PUMP AND MOTOR
G	PRESSURE TRANSDUCER W/ GAUGE
I	FLOW SENSOR
J	CONTROL CABINET (DEAD FRONT)

7 EQUIPMENT PAD PLAN
SCALE: 1" = 20'

BAR IS ONE INCH ON OFFICIAL DRAWINGS.
0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

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ABBREVIATIONS

A	AMPERES
AC	ALTERNATING CURRENT
AF	AMPERE FRAME
AFF	ABOVE FINISHED FLOOR
AG	ABOVE FINISHED GRADE
AICS	AMPERES INTERRUPTING CAPACITY, SYMMETRICAL
ASD	ADJUSTABLE SPEED DRIVE
AT	AMPERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
BC	BARE COPPER
C	CONDUIT
CB	CIRCUIT BREAKER
CO	CONDUIT ONLY
CKT	CIRCUIT
CPT	CONTROL POWER TRANSFORMER
CT	CURRENT TRANSFORMER
DB	DIRECT BURIED
DC	DIRECT CURRENT
DWG	DRAWING
ELEV	ELEVATION
ENCL	ENCLOSURE
EP	EXPLOSION PROOF
ETM	ELAPSED TIME METER
EXIST	EXISTING
FLEX	FLEXIBLE
GFI	GROUND FAULT INTERRUPTER
GFR	GROUND FAULT RELAY
GND	GROUND
HH	HANDHOLE
HOA	HAND OFF AUTOMATIC
HP	HORSEPOWER
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING
HZ	HERTZ
JB	JUNCTION BOX
KVA	KILOVOLT-AMPERES
KW	KILOWATT
LA	LIGHTNING ARRESTOR
LOS	LOCKOUT STOP PUSH-BUTTON
LS	LIMIT SWITCH
LTG	LIGHTING
MA	MILLIAMPERE
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MCM	THOUSAND CIRCULAR MILS
MIN	MINIMUM
MT	EMPTY
MTD	MOUNTED
N	NEUTRAL
NC	NORMALLY CLOSED
NL	NIGHTLIGHT
NO	NORMALLY OPEN
NO.	NUMBER
NTS	NOT TO SCALE
OL'S	MOTOR OVERLOAD CONTACTS
P	POLE
PB	PUSHBUTTON, PULLBOX
PH	PHASE
PS	PRESSURE SWITCH
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
REF	REFERENCE
REQ'D	REQUIRED
SH	SHIELDED
SHT	SHEET
STD	STANDARD
SW	SWITCH
TACH	TACHOMETER
TB	TERMINAL BOARD
TEL	TELEPHONE
TEMP	TEMPERATURE
TSP	TWISTED PAIR
XFMR	TRANSFORMER
TSP	TWISTED SHIELDED PAIR
TST	TWISTED SHIELDED TRIAD
TSTAT	THERMOSTAT
TYP	TYPICAL
UG	UNDERGROUND
UON	UNLESS OTHERWISE NOTED
V	VOLT
VFD	VARIABLE SPEED DRIVE
VS	VARIABLE SPEED
W	WATTS, WIRE
WP	WEATHERPROOF
ZS	POSITION SWITCH

ELECTRICAL SYMBOLS

- (UM) UTILITY METERING
- (AM) METERING DEVICE:
  AM–AMMETER
  VM–VOLTMETER
  WM–WATTMETER
  FM–FREQUENCY METER
  WHM–KILOWATT HOUR METER
  DM–DIGITAL MULTI–FUNCTION METER
  MFM–MULTI–FUNCTION METER
- [AS] AMMETER SWITCH
- [VS] VOLTMETER SWITCH
- CURRENT TRANSFORMER, QUANTITY INDICATED
- POTENTIAL TRANSFORMER, QUANTITY INDICATED
- (25) SWITCHGEAR DEVICE:
  11 MULTIFUNCTION RELAY
  21 DISTANCE RELAY
  25 SYNCHRONIZING OR SYNCHRONISM CHECK DEVICE
  26Q TEMPERATURE RELAY
  27 UNDERVOLTAGE RELAY
  32 DIRECTIONAL POWER RELAY
  43 MANUAL TRANSFER OR SELECTOR DEVICE
  46 REVERSE–PHASE OR PHASE–BALANCE CURRENT RELAY
  47 PHASE–SEQUENCE VOLTAGE RELAY
  49 MACHINE OR TRANSFORMER THERMAL RELAY
  50 INSTANTANEOUS OVERCURRENT OR RATE OF RISE RELAY
  50G ZERO SEQUENCE GROUND FAULT RELAY
  51 A–C TIME OVERCURRENT RELAY
  52 A–C CIRCUIT BREAKER
  59 OVERVOLTAGE RELAY
  63 SUDDEN PRESSURE RELAY
  65 GOVERNOR
  67 A–C DIRECTIONAL OVERCURRENT RELAY
  81 FREQUENCY RELAY
  86 LOCKOUT RELAY
  87 DIFFERENTIAL PROTECTIVE RELAY
- [K] KEY INTERLOCKING OF EQUIPMENT
- [M] MECHANICAL INTERLOCKING OF EQUIPMENT
- [E] ELECTRICAL INTERLOCKING OF EQUIPMENT
- POWER FACTOR CORRECTING CAPACITOR
- [PMR] PHASE MONITORING RELAY
- [ETM] ELAPSED TIME METER
- [SPD] SURGE PROTECTIVE DEVICE
- [MFM] MULTI–FUNCTION METER
- [RTU] REMOTE TERMINAL UNIT
- [TB] TERMINAL BLOCK
- (TC) TRIP COIL
- GENERATOR NEUTRAL JUNCTION
- NEUTRAL GROUNDING RESISTOR (NGR)
- [STB] SHORTING TERMINAL BLOCK
- SS SYNCH SWITCH
- MEDIUM VOLTAGE SURGE ARRESTER
- X: 20A OR 3P; X: 100AF 80AT 3P — LOW VOLTAGE CIRCUIT BREAKER (CB). RATINGS AND NO. OF POLES AS SHOWN. WHEN SPECIFIC TYPE IS REQUIRED, X INDICATES TYPE.
  TYPES:
  MCCB – MOLDED CASE
  ICCB – INSULATED CASE
  LVP – LOW VOLTAGE POWER
  MCP – MOTOR CIRCUIT PROTECTOR (RATING PER CONNECTED LOAD)
- [CB] SEPARATELY MOUNTED CIRCUIT BREAKER, SEE ELECTRICAL ONE LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION
- [GFP] GROUND FAULT PROTECTION

ELECTRICAL SYMBOLS

- [52] MEDIUM VOLTAGE CIRCUIT BREAKER
- FUSE, SIZE AND NUMBER OF FUSES AS NOTED
- FUSED CUTOUT, CURRENT RATING, FUSE SIZE AND NUMBER OF POLES AS NOTED
- FUSIBLE SWITCH, CURRENT RATING, FUSE SIZE AND QUANTITY AS NOTED
- NON–FUSED SWITCH, CURRENT RATING AND NUMBER OF POLES AS NOTED
- DISCONNECT OR DRAWOUT CONNECTION
- TYPE/SIZE, FEATURES — MOTOR CONTROLLER

TYPE/SIZE
SUCCEEDING NUMBER INDICATES NEMA STARTER SIZE
FVR = FULL VOLTAGE REVERSING
FVNR = FULL VOLTAGE NON–REVERSING
RVSS = REDUCED VOLTAGE SOFT STARTER
VFD = VARIABLE FREQUENCY DRIVE
2S2W = TWO–SPEED TWO–WINDING
2S1W = TWO SPEED ONE–WINDING

FEATURES
1 – CONTROL POWER TRANSFORMER, 120V SECONDARY
2R – 2: DENOTES INDICATING LIGHT MODIFIER:
R – RED
G – GREEN
A – AMBER
W – WHITE
3A – 3: DENOTES CONTROL SWITCH MODIFIER:
A – HAND–OFF–AUTO
B – HAND–OFF–REMOTE
C – ON–OFF
D – FORWARD–OFF–REVERSE
4 – START–STOP PUSHBUTTONS, MOMENTARY
5 – ELAPSED TIME METER
6 – KEYPAD/DISPLAY ON DOOR
7 – OUTPUT dV/dT FILTER
8 – DISCONNECT SWITCH

- OL — THERMAL OVERLOAD ELEMENT
- THERMAL OVERLOAD RELAY CONTACT
- (7.5 OR HP) MOTOR WITH DESIGN HORSEPOWER (WHEN INDICATED)
- (G) GENERATOR
- TRANSFER SWITCH, CURRENT RATING AND NUMBER OF POLES AS NOTED. ATS – AUTOMATIC, MTS – MANUAL
- TRANSFORMER
  △ 3 PHASE, 3 WIRE DELTA CONNECTION
  Y 3 PHASE, 4 WIRE GROUNDED WYE CONNECTION
- [NAME VOLTAGE] SWITCHBOARD OR PANELBOARD. NAME, VOLTAGE, PHASE, NUMBER OF WIRES WHEN INDICATED.
- △ DELTA CONNECTION
- WYE CONNECTION
- GROUNDED WYE CONNECTION
- MANUAL MOTOR STARTER
- OL'S — MOTOR OVERLOAD HEATER CONTACTS
- MOTOR OVERLOAD HEATER
- [S] SOLENOID OPERATED VALVE
- MOTOR
- ALARM
- FUSE
- CONTROL POWER TRANSFORMER
- GROUND
- WIRING IN MOTOR STARTER
- FIELD WIRING

ELECTRICAL SYMBOLS PLANS

LIGHT FIXTURES

- CEILING/PENDANT MOUNTED FIXTURE
- CEILING/PENDANT MOUNTED FIXTURE, EMERGENCY/NIGHT LIGHT
- WALL MOUNTED FIXTURE
- CEILING/PENDANT MOUNTED FIXTURE
- WALL MOUNTED FIXTURE
- CEILING/PENDANT MOUNTED FIXTURE, EMERGENCY/NIGHT LIGHT
- WALL MOUNTED FIXTURE, EMERGENCY/NIGHT LIGHT
- EXIT LIGHT, CEILING MOUNTED, ARROW DIRECTION AS INDICATED. SHADED SECTION INDICATES ILLUMINATION FACE.
- EXIT LIGHT, WALL MOUNTED, ARROW DIRECTION AS INDICATED. SHADED SECTION INDICATES ILLUMINATION FACE.
- EMERGENCY LIGHT FIXTURE, 2 ATTACHED HEADS AS SHOWN
- EMERGENCY LIGHT, REMOTE MOUNTED HEAD

FIRE ALARM SYSTEM

- [F] MANUAL PULL STATION, 48" ABOVE FLOOR
- VISUAL ALARM LIGHT 80" ABOVE FLOOR OR AS NOTED
- AUDIBLE ALARM DEVICE WITH VISUAL ALARM LIGHT 80" ABOVE FLOOR OR AS NOTED
- [F] COMBINATION AUDIBLE ALARM DEVICE AND VISUAL ALARM LIGHT 80" ABOVE FLOOR, AND MANUAL PULL STATION 48" ABOVE FLOOR
- GENERAL ALARM BELL 80" ABOVE FLOOR OR AS NOTED
- [F] VISUAL ALARM LIGHT 80" ABOVE FLOOR, AND MANUAL PULL STATION 48" ABOVE FLOOR.
- (F) THERMAL FIRE DETECTOR, COMBINATION RATE OF RISE AND FIXED TEMPATURE. '200' INDICATES 200 DEGREE FIXED TEMPATURE. '135' INDICATES 135 DEGREE FIXED TEMPATURE. 'ST' INDICATES DETECTOR TO INITIATE ELEVATOR C.B. SHUNT–TRIP.
- (F) AUTOMATIC DOOR RELEASE CONNECTION
- SMOKE DAMPER CONNECTION
- [F] SMOKE DETECTOR ON CEILING;
  'D'–INDICATES DUCT DETECTOR TYPE
  'R'–INDICATES RELAY FOR AUXILIARY CONTROLS
  'ER' INDICATES DETECTOR TO INITIATE ELEVATOR RECALL
  'PT' INDICATES PROJECTED BEAM TYPE TRANSMITTER
  'PR' INDICATES PROJECTED BEAM TYPE RECEIVER
- [F] FAN SHUT–DOWN CONNECTION
- (R) REMOTE DETECTOR INDICATOR LIGHT
- (R) DUCT SMOKE DETECTOR REMOTE TEST/RESET STATION
- (FS) SPRINKLER FLOW SWITCH CONNECTION
- (TS) TAMPER–PROOF SPRINKLER VALVE SWITCH CONNECTION
- [FAZ] FIRE ALARM ZONE ANNUNCIATOR
- [FAM] FIRE ALARM MASTER ANNUNCIATOR
- [FACP] FIRE ALARM CONTROL PANEL
- [C] TELEPHONE STATION
- [G] GAS DETECTOR SENSOR
- FIRE ALARM ZONE

SITE

- LIGHTING CONTROL STATION, PAD MOUNTED
- LIGHTING CONTROL STATION, POLE MOUNTED
- HAND HOLE
- (J) JUNCTION BOX
- [T] UTILITY TRANSFORMER, PAD MOUNTED
- (T) UTILITY TRANSFORMER, POLE MOUNTED
- [PC] PHOTOCELL
- (MH) MAN HOLE
- UNDERGROUND CONDUIT
- POLE MOUNTED LIGHTING UNIT, AS SPECIFIED
- BACK MOUNTED LIGHTING UNIT, AS SPECIFIED
- TOWER LIGHTING UNIT, AS SPECIFIED
- ATHLETIC FIELD LIGHTING UNIT, AS SPECIFIED

CONDUIT, RACEWAY AND WIRING

- CONDUIT TURNING UP
- CONDUIT TURNING DOWN
- HOME RUN TO PANEL, 2 #12, 1 #12G IN 3/4"C UNLESS OTHERWISE NOTED
- CIRCUIT RUN BETWEEN DEVICES EXPOSED IN NON–ARCHITECTURALLY FINISHED AREAS, CONCEALED IN ARCHITECTURALLY FINISHED AREAS. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT
- CONDUIT RUN BETWEEN DEVICES CONCEALED IN NON–ARCHITECTURALLY FINISHED AREAS OR UNDER FLOOR SLAB. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT.
- CIRCUIT CONTINUATION
- CONDUIT STUBBED OUT AND CAPPED
- CONDUIT TAG OR CIRCUIT NUMBER – WIRE AND CONDUIT SIZE AS SPECIFIED IN CIRCUIT SCHEDULE ON THE SHEETS
- PLUG IN STRIP–TYPE RECEPTACLES OR OTHER OUTLETS AS INDICATED
- LAY IN WIREWAY DUCT, SIZE AS NOTED
- FEEDER DUCT–RATING AND NUMBER OF CONDUCTORS AS NOTED
- PLUG IN DUCT–RATING AND NUMBER OF CONDUCTORS AS NOTED
- CABLE TRAY, TYPE AS NOTED

CONDUIT TAGS
A. GRS: GALVANIZED RIGID STEEL
B. RAC: RIGID ALUMINUM CONDUIT
C. PVC–GRS: PVC COATED GALVANIZED RIGID STEEL CONDUIT
D. PVC: RIGID POLYVINYL CHLORIDE CONDUIT
E. EMT: ELECTRICAL METALLIC TUBING CONDUIT (THINWALL)
F. LFMC: LIQUIDTIGHT FLEXIBLE METAL CONDUIT
G. HDPE: HIGH DENSITY POLYETHYLENE CONDUIT
H. FMC: FLEXIBLE METAL CONDUIT

COMMUNICATIONS SYSTEM

- (S) SPEAKER OUTLET RECESSED IN CEILING (UNLESS NOTED OTHERWISE), 'S'–INDICATES SURFACE TYPE, 'C'–INDICATES SPEAKER CONCEALED ABOVE CEILING, 'P'–INDICATES PROJ. HORN TYPE, 'DF'–INDICATES DOUBLE FACE TYPE
- TELEPHONE OUTLET, IN WALL 16" ABOVE FLOOR OR AS NOTED. 'W' INDICATES WALL MOUNTED TELEPHONE AT 54"
- COMPUTER TERMINAL OUTLET–IN WALL OR AS NOTED
- COMBINATION TELEPHONE & COMPUTER TERMINAL OUTLET IN WALL 16" ABOVE FLOOR OR AS NOTED
- TELEPHONE OUTLET, IN FLOOR BOX
- [V] VOLUME CONTROL, NUMERAL DESIGNATES ASSOCIATED SPEAKERS

GROUNDING

- GROUND GRID CONDUCTOR (SIZE PER DWG.)
- GROUND ROD
- GROUND SYSTEM TEST WELL
- EXOTHERMIC WELDED GROUND CONNECTION
- EQUIPMENT GROUND CABLE STUB–UP
- [MGB] MAIN GROUND BAR

WIRING DEVICE

- (C) CLOCK HANGER RECEPTACLE–20A , 125V, 2P, 3W (NEMA 5–20R), IN WALL +84" OR AS NOTED
- SIMPLEX RECEPTACLE – 125V, 2P, 3W 20A, 30A, OR 50A AT OUTLET INDICATES AMP, RATING (NEMA 5–20R, 5–30R, OR 5–50R), IN WALL OR AS NOTED
- DUPLEX RECEPTACLE–20A, 125V, 2P, 3W (NEMA 5–20R), IN WALL
- DUPLEX RECEPTACLE–20A, 125V, 2P, 3W (NEMA 5–20R) IN CEILING
- DUPLEX RECEPTACLE–20R, 125V, 2P,3W (NEMA 5–20R), IN WALL ABOVE COUNTER TOP OR BACK SPLASH 'GFI'–INDICATES GROUND FAULT INTERRUPTER TYPE 'SS'–INDICATES SURGE SUPPRESSER TYPE 'IG'–INDICATES ISOLATED GROUND TYPE
- DUPLEX RECEPTACLE–20R, 125V, 2P, 3W (NEMA 5–20R), IN WALL OR AS NOTED, ONE RECEPTACLE HOT, ON RECEPTACLE SWITCH
- FLOOR OUTLET BOX WITH SIMPLEX RECEPTACLE–20A, 125V, 2P, 3W (NEMA 5–20R)
- FLOOR OUTLET WITH DUPLEX RECEPTACLE
- OUTLET WITH SPECIAL DEVICE AS NOTED, IN WALL
- OUTLET WITH SPECIAL DEVICE AS NOTED, IN FLOOR
- OUTLET WITH SPECIAL DEVICE AS NOTED, IN CEILING
- (J) JUNCTION BOX OR OUTLET BOX
- SINGLE POLE WALL SWITCH:
  # – INDICATES 2–WAY, 3–WAY OR 4–WAY
  PL – PILOT LIGHT
  L/T – LOCKING TYPE
  LV – LOW VOLTAGE TYPE
  T – TIMER
  MC – MOMENTARY CONTACT
- [P] PULL BOX
- PUSHBUTTON, AS NOTED
- LOCAL LIGHT DIMMER, M INDICATES MASTER CONTROLLER 1000 INDICATES 1000 WATTS 1500 INDICATES 1500 WATTS 2000 INDICATES 2000 WATTS
- MOTOR SPEED CONTROLLER 2–SPEED, 3–SPEED OR VARIABLE SPEED AS INDICATED
- [DH] MAGNETIC DOOR HOLD

EQUIPMENT

- MOTOR CONNECTION
- (E) EQUIPMENT TERMINAL POINT
- SAFETY DISCONNECT SWITCH, NON–FUSED UNLESS NOTED (F)
- $M MOTOR RATED SWITCH, NO. OF POLES AS REQUIRED.
- [FS] FUSE HOLDER WITH FUSESTAT AND TOGGLE SWITCH
- MOTOR STARTER–MAGNETIC UNLESS NOTED MAN. (MANUAL)
- COMBINATION MOTOR STARTER AND FUSED DISCONNECT SWITCH–MAGNETIC STARTER
- COMBINATION MOTOR STARTER AND NON–FUSED DISCONNECT SWITCH–MAGNETIC STARTER
- BRANCH CIRCUIT PANELBOARD SURFACE MOUNTED
- BRANCH CIRCUIT PANELBOARD FLUSH MOUNTED
- SPECIAL CABINET OR EQUIPMENT AS NOTED SURFACE MOUNTED
- SPECIAL CABINET OR EQUIPMENT AS NOTED FLUSH MOUNTED
- [T15] DRY–TYPE TRANSFORMER, NUMBER INDICATES KVA SIZE
- POWER DISTRIBUTION PANELBOARD SURFACE MOUNTED OR FREESTANDING, AS NOTED
- POWER DISTRIBUTION PANELBOARD, ELECTRICAL EQUIPMENT MCC OR SWITCHBOARD, FLUSH MOUNTED
- [ATS] AUTOMATIC TRANSFER SWITCH
- [MTS] MANUAL TRANSFER SWITCH
- [CS] CONTROL STATION
- [LC] LIGHTING CONTACTOR

SECURITY SYSTEM

- [K] KEYPAD STATION
- (K) KEYPAD ACCESS CONTROL
- (C) CARD ACCESS READER
- (C)(K) COMBINATION KEYPAD ACCESS CONTROL & CARD ACCESS READER
- (G) GLASS BREAK SENSOR
- (D) SECURE DOOR. ELECTRICAL STRIKE & CONTACTS AS SCHEDULED
- (W) SECURE WINDOW
- (M) SECURITY MOTION SENSOR, AS INDICATED
- (P) SECURITY ACCESS PROXIMITY SENSOR
- CLOSE CIRCUIT TELEVISION CAMERA FIXED MOUNTED
- CLOSED CIRCUIT TELEVISION CAMERA REMOTE PAN, TILT, & CONTROL
- [DC] DOOR CABINET
- [SEC] SECURITY EQUIPMENT CONTROL PANEL

VENTILATION ALARM SYSTEM

- HORN
- STROBE
- PUSHBUTTON ENCLOSURE W/ PILOT LIGHTS

MISCELLANEOUS

- (T) THERMOSTAT 48" ABOVE FLOOR.
- [PC] PHOTOCELL CONTROL
- [HD] ELECTRIC HAND DRYER AS NOTED.
- (E1) REFERENCED NOTE
- [TS] TIME SWITCH
- [TMGB] TELECOMMUNICATIONS MAIN GROUND BAR AT 80" OR AS NOTED.
- [TGBXX] TELECOMMUNICATIONS GROUND BAR. 'XX' INDICATES GROUND BAR NUMBER.
- (S) OCCUPANCY SENSOR, CEILING MOUNTED
- (S) OCCUPANCY SENSOR, WALL MOUNTED, 48" ABOVE FLOOR
- EM — SPECIAL SYSTEM WIRING TO CENTRAL EQUIPMENT, PANEL, TERMINAL CABINET OR NEXT DEVICE.
  EM = EMERGENCY SYSTEM
  FO = FIBER OPTIC
  MVE = MEDIUM VOLTAGE ELECTRICAL
  E = ELECTRIC AS NOTED
  GF = CIRCUIT TO GROUND FAULT CIRCUIT BREAKER
  EIL = EQUIPMENT INTERLOCK
  MT = EMPTY CONDUIT

NOTES

1. ALL WALL RECEPTACLES, TELEPHONE OUTLETS OR SIMILAR OUTLETS TO BE 16" ABOVE FLOOR TO BOTTOM UNLESS OTHERWISE INDICATED.
2. ALL WALL SWITCHES, PUSHBUTTONS AND DIMMERS TO BE 48" ABOVE FLOOR TO BOTTOM UNLESS OTHERWISE INDICATED.
3. UPPER CASE LETTERS 'XX' AT DEVICE INDICATES AS NOTED;
   DD = DOUBLE DUPLEX RECEPTACLES IN TWO GANG BOX
   IG = ISOLATED GROUND TYPE
   SS = SURGE SUPPRESSION TYPE
   GFI = GROUND FAULT INTERRUPTER TYPE
   WP = WEATHERPROOF
   XP = EXPLOSION PROOF
   TL = TWIST LOCK TYPE
   WG = WIREGUARD TO BE PROVIDED
   RI = ROUGH–IN ONLY
4. LOWER CASE LETTERS AT SWITCHES AND FIXTURES INDICATE ASSOCIATED UNITS FOR SWITCHING.
5. UPPER CASE LETTERS AT FIXTURE INDICATE FIXTURE TYPE.
6. NUMBER AT FIXTURE OR OUTLET INDICATES PANEL CIRCUIT NUMBER.
7. PLUS (+) SIGN WITH DIMENSION AT OUTLET INDICATES HEIGHT ABOVE FINISHED FLOOR LINE OR HEIGHT ABOVE FINISHED GRADE.

NOTE:
NOT ALL SYMBOLS SHOWN IN THESE LISTS MAY BE USED IN THIS PROJECT. CONTACT ARCHITECT OR ENGINEER FOR CLARIFICATION OF ANY DISCREPANCIES.

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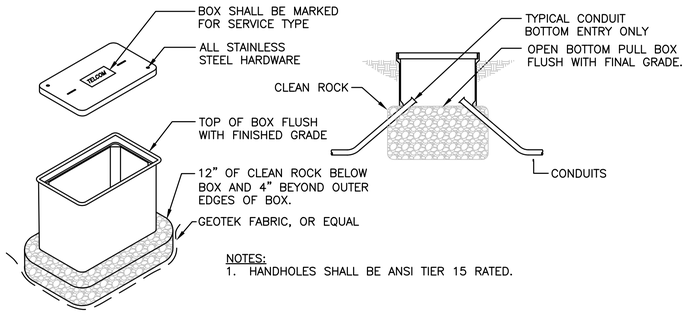
DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

ELECTRICAL
ELECTRICAL LEGEND

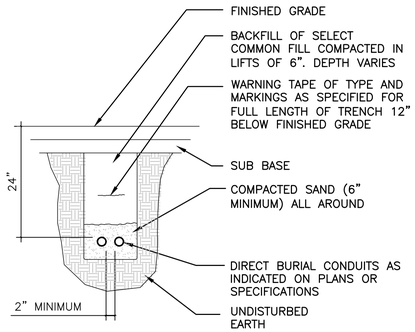
SHEET E.001

14

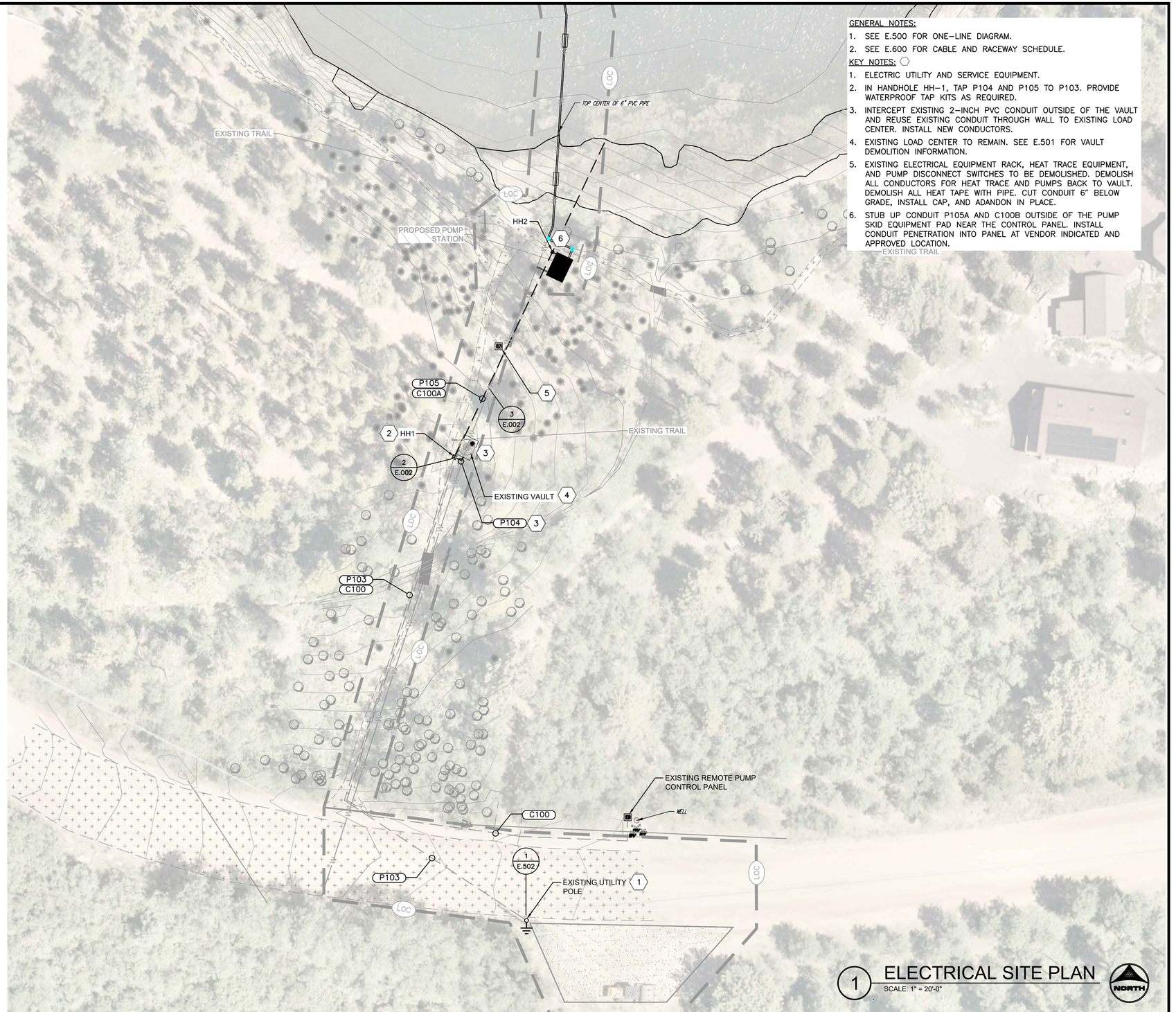
HANDHOLE SCHEDULE			
TAG	MFR	MODEL	DIMENSIONS (L"xW"xD")
HH-1	QUAZITE	PC1212BA12	12"x12"x12"
HH-2	QUAZITE	PC1212BA12	12"x12"x12"



NOTES:
1. HANDHOLES SHALL BE ANSI TIER 15 RATED.



DIRECT BURIED CONDUIT DETAIL



GENERAL NOTES:
1. SEE E.500 FOR ONE-LINE DIAGRAM.
2. SEE E.600 FOR CABLE AND RACEWAY SCHEDULE.

KEY NOTES:
1. ELECTRIC UTILITY AND SERVICE EQUIPMENT.
2. IN HANDHOLE HH-1, TAP P104 AND P105 TO P103. PROVIDE WATERPROOF TAP KITS AS REQUIRED.
3. INTERCEPT EXISTING 2-INCH PVC CONDUIT OUTSIDE OF THE VAULT AND REUSE EXISTING CONDUIT THROUGH WALL TO EXISTING LOAD CENTER. INSTALL NEW CONDUCTORS.
4. EXISTING LOAD CENTER TO REMAIN. SEE E.501 FOR VAULT DEMOLITION INFORMATION.
5. EXISTING ELECTRICAL EQUIPMENT RACK, HEAT TRACE EQUIPMENT, AND PUMP DISCONNECT SWITCHES TO BE DEMOLISHED. DEMOLISH ALL CONDUCTORS FOR HEAT TRACE AND PUMPS BACK TO VAULT. DEMOLISH ALL HEAT TAPE WITH PIPE. CUT CONDUIT 6" BELOW GRADE, INSTALL CAP, AND ADANDON IN PLACE.
6. STUB UP CONDUIT P105A AND C100B OUTSIDE OF THE PUMP SKID EQUIPMENT PAD NEAR THE CONTROL PANEL. INSTALL CONDUIT PENETRATION INTO PANEL AT VENDOR INDICATED AND APPROVED LOCATION.

1 ELECTRICAL SITE PLAN
SCALE: 1" = 20'-0"

NORTH

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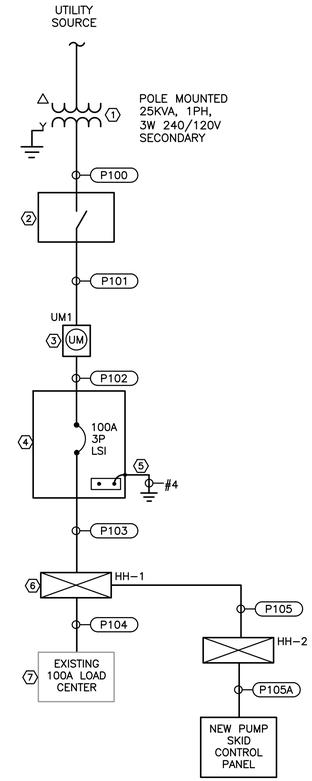
DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

ELECTRICAL
OVERALL SITE PLAN

SHEET E.002

15



1 ONE-LINE DIAGRAM
SCALE: NONE

GENERAL NOTES:

1. UTILITY CONTACT: SEE SECTION 26 2100.
2. REFER TO SHEET E.002 FOR LOCATION OF ELECTRICAL EQUIPMENT.
3. REFER TO SHEET E.600 FOR CABLE AND RACEWAY SCHEDULE.

KEY NOTES: ⬡

1. POLE-MOUNTED TRANSFORMER BY UNITED POWER.
2. NEMA 4X STAINLESS STEEL, 240V, 2-POLE, 100 AMP METER DISCONNECT SWITCH. SEE DETAIL 1/E.501.
3. 100 AMP SELF-CONTAINED METER SOCKET MEETING UTILITY REQUIREMENTS. SEE DETAIL 1/ E.501.
4. NEMA 4X STAINLESS STEEL, 240V, 2-POLE, 100 AMP SERVICE DISCONNECT CIRCUIT BREAKER WITH ELECTRONIC TRIP UNIT. SEE DETAIL 1/E.501.
5. BOND NEUTRAL TO GROUND AT SERVICE DISCONNECT BREAKER AND CONNECT TO GROUND RODS WITH #4 BARE COPPER IN 3/4 PVC CONDUIT.
6. IN HANDHOLE HH-1, TAP P104 AND P105 TO P103. PROVIDE WATERPROOF TAP KITS AS REQUIRED.
7. REUSE EXISTING 2 PVC CONDUIT INSIDE THE VAULT TO LOAD CENTER. INTERCEPT THE CONDUIT OUTSIDE OF THE VAULT AND CONNECT NEW CIRCUIT P104 TO EXISTING CONDUIT.

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APPROVED: GLP | JOB NUMBER: 2202658
CAD DATE: 8/6/2024
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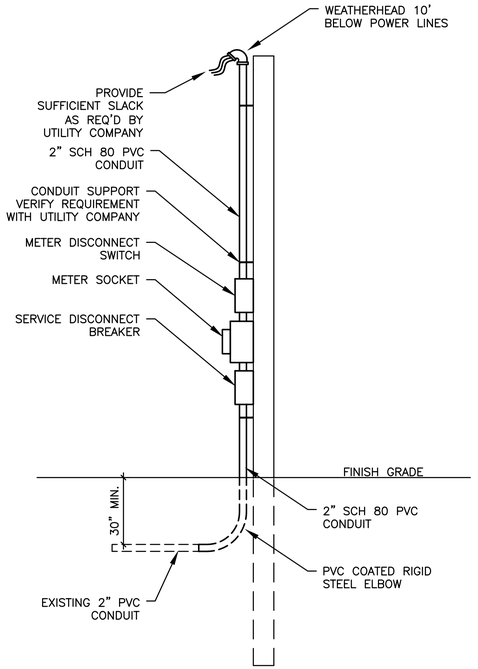
ELECTRICAL
ONE-LINE DIAGRAM

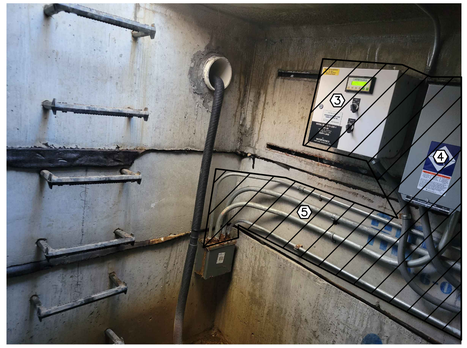


1 UTILITY POLE RISER DETAIL
SCALE: NONE

KEY NOTES:

1. DEMOLISH EXISTING METER CABINET AND ASSOCIATED CONDUIT AND WIRING.
2. DEMOLISH EXISTING SERVICE DISCONNECT AND ASSOCIATED CONDUIT AND WIRING. DEMOLISH CONDUIT TO BELOW GRADE HORIZONTAL RUN AND CONNECT NEW CONDUIT AS SHOWN IN DETAIL 1/E501.
3. DEMOLISH EXISTING PUMP CONTROL PANEL AND ASSOCIATED CONDUIT AND WIRING.
4. DEMOLISH EXISTING PUMP MOTOR STARTERS AND ASSOCIATED CONDUIT AND WIRING.
5. DEMOLISH PUMP MOTOR FEEDER AND HEAT TAPE CONDUITS TO TOP OF JUNCTION BOX. CAP HOLES IN TOP OF JUNCTION BOX. ABANDON UNDERGROUND CONDUITS LEAVING THE VAULT FROM THE BACK OF THE JUNCTION BOX.
6. EXISTING LOAD CENTER TO REMAIN.
7. REUSE EXISTING 2" PVC CONDUIT INSIDE THE VAULT. INTERCEPT THE CONDUIT OUTSIDE OF THE VAULT AND CONNECT NEW CIRCUIT P104 TO EXISTING CONDUIT.
8. DEMOLISH HEAT TAPE CONTROLLER AND ASSOCIATED WIRING AND CONDUIT. DEMOLISH CONDUCTORS BACK TO SOURCE. DEMOLISH CONDUIT TO 6" BELOW GRADE, CAP THE CONDUIT, AND ABANDON UNDERGROUND CONDUIT IN PLACE.
9. DEMOLISH PUMP DISCONNECT SWITCHES AND ASSOCIATED WIRING AND CONDUIT. DEMOLISH CONDUCTORS BACK TO SOURCE. DEMOLISH CONDUIT TO 6" BELOW GRADE, CAP THE CONDUIT, AND ABANDON UNDERGROUND CONDUIT IN PLACE.

2 EXISTING METERING EQUIPMENT
SCALE: NONE



3 EXISTING PUMP CONTROL PANEL
SCALE: NONE

4 EXISTING PUMP STARTER AND CONTROL PANEL
SCALE: NONE

5 EXISTING HEAT TAPE EQUIPMENT
SCALE: NONE

6 EXISTING PUMP DISCONNECT SWITCHES
SCALE: NONE

7 EXISTING LOAD CENTER CONDUIT
SCALE: NONE

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DORY LAKE PUMP REPLACEMENT PROJECT
GILPIN COUNTY
GILPIN COUNTY, CO

ELECTRICAL
DETAILS

POWER & CONTROL CABLE & RACEWAY SCHEDULE

CIRCUIT #	FROM	TAG #	TO	TAG #	CONDUCTORS	CONDUIT	
~~P100~~	~~UTILITY POLE-MOUNTED TRANSFORMER~~		~~DISCONNECT SWITCH~~	~~DS1~~	~~3-#1 XHHW-2~~	~~2"~~	~~COIL 20' OF COI~~
P101	DISCONNECT SWITCH	DS1	METER SOCKET	UM1	3-#1 XHHW-2	2"	
P102	METER SOCKET		SERVICE DISCONNECT	SD1	3-#1 XHHW-2	2"	
P103	SERVICE DISCONNECT	SD1	HANDHOLE 1	HH-1	3-#1 XHHW-2, #8 GND	EXIST.	
P104	HANDHOLE 1	HH-1	EXISTING VAULT LOAD CENTER	LP	3-#1 XHHW-2, #8 GND	2"	TAPPED FROM P1
P105	HANDHOLE 1	HH-1	HANDHOLE 2	HH-2	3-#1 XHHW-2, #8 GND	2"	TAPPED FROM P1
P105A	HANDHOLE 2	HH-2	PUMP SKID CONTROL PANEL	PCP1	3-#1 XHHW-2, #8 GND	2"	
C100	LOCAL PUMP CONTROLS	LCP1	HANDHOLE 1	HH-1	10-#14, 1-#16 TSP, #14 GND	EXIST.	
C100A	HANDHOLE 1	HH-1	HANDHOLE 2	HH-2	10-#14, 1-#16 TSP, #14 GND	2"	
C100B	HANDHOLE 2	HH-2	PUMP SKID CONTROL PANEL	PCP1	10-#14, 1-#16 TSP, #14 GND	2"	

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