TECHNICAL SPECIFICATIONS

FOR

VADER – ENCHANTED VALLEY RESERVOIR

April 2018

VOLUME 2 OF 3

murraysmith

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See Table of Contents for author of each specification section, identified by author's initials as follows:

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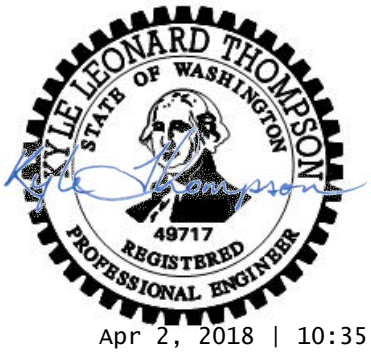 Apr 2, 2018 | 10:35 AM PDT	 Apr 2, 2018 | 10:50 AM PDT
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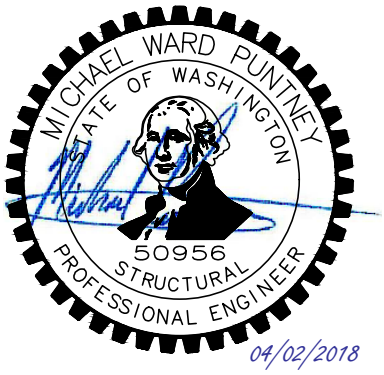	

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FOR
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SECTION 01 10 00

SUMMARY OF WORK

PART 1 GENERAL

These Technical Specifications supplement and amplify certain sections of the General Conditions and Supplementary General Conditions. The General Conditions and Supplementary General Conditions shall apply except as modified herein. These Technical Specifications may contain occasional requirements not pertinent to the project. However, these specifications shall apply in all particulars insofar as they are applicable to this project.

1.1 APPLICABLE STANDARD SPECIFICATIONS AND PLANS

Lewis County, Washington "Design and Construction Standards", 2016 (including all revisions at date of bid opening) and the Washington State Department of Transportation, Standard Specification for Road, Bridge and Municipal Construction, 2016 (including all revisions at date of bid opening), apply except as may be modified herein. In the case of discrepancy, unless noted otherwise herein, the more restrictive provisions shall apply.

1.2 SCOPE OF WORK

The work to be performed under these specifications and drawings consists of furnishing all labor, materials and equipment necessary for the construction of a 250,000-gallon, welded steel water reservoir, raw water pump station and their associated appurtenances, and water lines of the following approximated lengths: 145 linear feet of four-inch ductile iron water line, 210 linear feet of 10-inch ductile iron water line, and miscellaneous lengths of three-inch pipe. The above general outline of principal features of the work does not in any way limit the responsibility of the CONTRACTOR(s) to perform all work and furnish all equipment, labor and materials required by the specifications and drawings. The drawings and specifications shall be considered and used together. Anything appearing as a requirement of either shall be accepted as applicable to both even though not so stated therein or shown.

No attempt has been made in these specifications or drawings to segregate work covered by any trade or subcontract under one specification. Such segregation and establishment of subcontract limits will be solely a matter of specific agreement between the CONTRACTOR and its subcontractors and shall not be based upon any inclusion, segregation or arrangement in or of these specifications.

1.3 COORDINATION OF DRAWINGS AND SPECIFICATIONS

The drawings and specifications are intended to describe and provide for a complete work. Any requirement in one is as binding as if stated in all. The CONTRACTOR shall provide any work or materials clearly implied in the Contract Documents even if the Contract Documents

do not mention it specifically. If there is a conflict within the Contract Documents, it will be resolved by the following order of precedence:

A. Permits for outside agencies required by law
B. OWNER-CONTRACTOR Agreement
C. Addenda to Contract Documents
D. CONTRACTOR's Proposal
E. Special Provisions
F. Contract Drawings
G. Technical Specifications
H. Supplementary General Conditions
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K. Lewis County, Washington, Standard Details
L. WSDOT Standard Specification for Road, Bridge and Municipal Construction, 2016
M. WSDOT Standard Plans

Dimensions shown on the drawings or that can be computed shall take precedence over scaled dimensions. Notes on drawings are part of the drawings and govern in the order described above. Notes on drawings shall take precedence over drawing details.

The intent of the drawings and specifications is to prescribe the details for the construction and completion of the work which the CONTRACTOR undertakes to perform according to the terms of the Contract. Where the drawings or specifications describe portions of the work in general terms, but details are incomplete or silent, it is understood that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. Unless otherwise specified, the CONTRACTOR shall furnish all labor, materials, tools, equipment, and incidentals, and do all the work involved in executing the Contract in a manner satisfactory to the ENGINEER.

The contract drawings are designated by general title, sheet number and sheet title. When reference is made to the drawings, the "Sheet Number" of the drawing will be used. Each drawing bears the ENGINEER's File No. 16-1846 and the general title:

LEWIS COUNTY PUBLIC WORKS

VADER-ENCHANTED VALLEY RESERVOIR

The specific titles of each sheet are contained on sheet G-1 of the Drawings.

1.4 CODE REQUIREMENTS

All work shall be done in strict compliance with the requirements of:

A. International Building Code
B. Uniform Mechanical Code

C. Uniform Plumbing Code
D. National Electric Code
E. National Electric Safety Code
F. Washington State Department of Labor and Industries
G. Lewis County

In case of disagreement between codes or these specifications, the more restrictive shall prevail.

1.5 COORDINATION WITH OTHER CONTRACTORS AND WITH OWNER

Certain work within this contract may require connection to and coordination with the work of other contractors and OWNER. The CONTRACTOR under these specifications shall cooperate fully with all other contractors and OWNER and carefully fit its own work to such other work as may be directed by the ENGINEER. The CONTRACTOR shall not commit or permit any act to be committed which will interfere with the performance of work by any other contractor or the OWNER.

1.6 ACCESS TO WORK

Access to the work shall be provided as may be required by the OWNER or its representatives, and all authorized representatives of the state and federal governments and any other agencies having jurisdiction over any phase of the work, for inspection of the progress of the work, the methods of construction or any other required purposes.

1.7 PERMITS AND LICENSES

Unless provided for otherwise in these contract documents, all permits, licenses and fees shall be obtained by the CONTRACTOR and all costs shall be borne by the CONTRACTOR. CONTRACTOR shall pay all plan check fees and other fees necessary to obtain permits and shall accommodate special inspections required thereof. CONTRACTOR shall be responsible for compliance with all permit provisions and shall accommodate all special inspections required thereof, all at no additional expense to the OWNER beyond prices as bid.

The following permits have been obtained by the OWNER:

- Lewis County Fill and Grade
- Washington Department of Natural Resources Forest Practices Act
- Lewis County Stormwater
- Lewis County Building

1.8 SITE INVESTIGATION AND PHYSICAL DATA

The CONTRACTOR acknowledges that it is satisfied as to the nature and location of the work and the general and local conditions, including but not limited to those bearing upon transportation, disposal, handling and storage of materials, availability of water, roads,

groundwater, access to the sites, coordination with other contractors, and conflicts with pipelines, structures and other contractors. Information and data furnished or referred to herein is furnished for information only. Any failure by the CONTRACTOR to become acquainted with the available information and existing conditions will not be a basis for relief from successfully performing the work and will not constitute justification for additional compensation.

The CONTRACTOR shall verify the locations and elevations of existing pipelines, structures, grades and utilities, prior to construction. The OWNER assumes no responsibility for any conclusions or interpretations made by the CONTRACTOR on the basis of the information made available.

1.9 TEMPORARY UTILITIES FOR CONSTRUCTION PURPOSES

The CONTRACTOR shall make all arrangements necessary to provide all temporary utilities for construction purposes and shall pay all costs associated those temporary utilities. Water for construction purposes will be furnished by the OWNER at no cost. The CONTRACTOR shall furnish all valves, hoses, connections and other devices as necessary to obtain sufficient water for construction and for filling and testing of water lines as required. Fire hydrant use is allowed only by permission of the utility owner. Backflow protection is required on all connections to potable water systems.

1.10 FIELD SERVICE BY MANUFACTURER'S REPRESENTATIVE

The CONTRACTOR shall furnish the services of a manufacturer's or material supplier’s representative for all major equipment and materials furnished by the CONTRACTOR or OWNER under this contract, to check, place in operation and test the installation, and train operating personnel. The manufacturer's representative shall be qualified and authorized to perform repairs and maintenance on the equipment. The above gives a general scope of the services desired from the manufacturer's representative. It will be the responsibility of the CONTRACTOR and the equipment manufacturer to determine detailed requirements. Costs for services of the manufacturer's representative shall be included in the proposal of the CONTRACTOR. The operator training mentioned above shall include sufficient time during the CONTRACTOR’s operation and testing period to fully explain to the operating personnel the features of the equipment and maintenance thereof.

1.11 CONSTRUCTION WITHIN PUBLIC RIGHTS-OF-WAY

When the work contemplated is wholly or partly within the right-of-way of a public agency such as a city, county or state, the OWNER will obtain from these agencies any right-of-way and street opening permits and all other necessary permit(s) required for the work. The CONTRACTOR shall abide by all regulations and conditions stipulated in the permit(s). Such conditions and requirements are hereby made a part of these specifications, as fully and completely as though the same were fully set forth herein. The CONTRACTOR shall examine the permit(s) granted to the OWNER by any city, county, state and federal agencies. Failure

to do so will not relieve the CONTRACTOR from compliance with the requirements stated therein.

The CONTRACTOR shall obtain all construction permits and pay all fees or charges and furnish any bonds and insurance coverages as necessary to ensure that all requirements of the city, county, state or federal agencies will be observed and the roadway and ditches are restored to their original condition or one equally satisfactory. A copy of all permits shall be kept on the work site for use of the ENGINEER.

1.12 CONSTRUCTION WITHIN PRIVATE EASEMENTS

When portions of the work contemplated are within easements held by the OWNER on private property, the CONTRACTOR shall ascertain for itself to what extent the width, status and special conditions attached to easements may have on its operations and all costs resulting therefrom shall be included and absorbed in the unit prices of the CONTRACTOR's bid. CONTRACTOR shall coordinate with private property owners and businesses if required. Landscaping, surface restoration and fence restoration shall be completed within 24 hours following piping and conduit installation and other construction work. Temporary fencing shall be provided continuously until such private fencing is properly restored.

The CONTRACTOR's attention is directed to Paragraph 6.20 of the General Conditions regarding safety and the protection of property. Certain portions of this project require working in close proximity to existing structures and property within private easements. It is the CONTRACTOR'S responsibility to conduct its operations and limit the size of equipment used in such a manner so as to prevent damage to existing property from excessive vibration or from other direct or indirect CONTRACTOR operations. The cost associated with repairing or replacing property that is damaged by the CONTRACTOR's operations shall be the responsibility of the CONTRACTOR, in accordance with the General Conditions.

1.13 RAILROAD CROSSINGS

Whenever a utility passes under a railroad or is on a railroad right-of-way, the work to be done shall be subject to the approval of proper officials of the railroad involved. Drawings and specifications will be filed by the OWNER with the railroad concerned prior to the time of bidding, but it is the responsibility of the CONTRACTOR to determine the requirements of the railroad with respect to maintaining traffic, amounts of insurance, and allowable construction procedures. All costs due to the existence of railroad track and other related facilities and the requirements of the railroads shall be covered by the price bid in the CONTRACTOR's proposal

1.14 PRIVATE ROADS AND DRIVEWAYS

Bridges at entrances to business properties where vehicular traffic is necessary shall be provided and maintained. Bridges shall be adequate in width and strength for the service required. No private road or driveway may be closed without approval of the ENGINEER

unless written authority has been given by the owner whose property has been affected. Driveways shall be left open and ready for use at the end of the work shift. All expenses involved in providing for construction, maintenance, and use of private roads or driveways, shall be borne by the CONTRACTOR and the amount thereof absorbed in the unit prices of the CONTRACTOR's bid.

1.15 TRAFFIC CONTROL AND PROTECTION

The CONTRACTOR shall maintain traffic control and protection in the work areas twenty-four (24) hours per day. Traffic control shall conform to the standards set forth in the "Washington Manual on Uniform Traffic Control Devices" issued by the Washington Department of Transportation.

The CONTRACTOR shall conduct its operations so as to keep one lane of traffic open for public and private access at all times on City, County and Public streets, roads and highways. If required by the State, the CONTRACTOR shall conduct its operations so as to keep both directions of traffic open on State Highways. Permits obtained for the project may have more stringent requirements than noted in this section.

Prior to beginning construction, the CONTRACTOR shall submit a detailed street closure and traffic control plan to the ENGINEER for approval. As construction proceeds, the CONTRACTOR shall notify the ENGINEER as to the status of street closures and detours.

On streets where traffic is heavy, the ENGINEER may require the construction of two-way bridges of adequate design. These bridges shall be provided with guard rails and shall be well lighted at all times. Detours as required by the ENGINEER shall be surfaced with gravel or crushed rock and maintained in good condition. Detours for pedestrians shall not exceed one block in length, and foot bridges over the trenches shall be provided with adequate handrails.

All work shall be carried on with due regard for safety to the public. Open trenches shall be provided with barricades of a type that can be seen at a reasonable distance, and at night they shall be distinctly indicated by adequately placed lights.

1.16 LIMITS OF THE WORK AND STORAGE OF SPOILS

The limits of the site which may be used for construction, storage, materials handling, parking of vehicles and other operations related to the project include the project site as shown on the drawings and adjacent public rights-of-way subject to permission of the public owner of that right-of-way. The limits of work also include rights of access obtained by the CONTRACTOR, subject to all public laws and regulations and rights of access by utility companies and other holders of easement rights.

1.17 EXISTING WATER SYSTEM SHUTDOWN

If the project involves the need to shut down an existing water system, the CONTRACTOR

shall coordinate the work to insure a minimum of shutdown time. The CONTRACTOR shall submit a written shutdown schedule to the ENGINEER for approval. The CONTRACTOR shall provide 72-hour notice preceding each shutdown. See Section 33 12 13, Water Service Connections, for additional requirements.

1.18 TESTING AND OPERATION OF FACILITIES

It is the intent of the OWNER to have a complete and operable facility. All of the work under this contract will be fully tested and inspected in accordance with the specifications. Upon completion of the work, the CONTRACTOR shall operate the completed facilities as required to test the equipment under the direction of the ENGINEER. During this period of operation by the CONTRACTOR, the new facilities will be tested thoroughly to determine their acceptance.

1.19 SALVAGE AND DEBRIS

Unless otherwise indicated on the drawings or in the specifications, all castings, pipe, equipment, demolition debris, spoil or any other discarded material or equipment shall become the property of the CONTRACTOR and shall be disposed of in a manner compliant with applicable Federal State and local laws and regulations governing disposal of such waste products. No burning of debris or any other discarded material will be permitted.

1.20 SAFETY STANDARDS AND ACCIDENT PREVENTION

The CONTRACTOR shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and not be limited to normal working hours. The required and/or implied duty of the ENGINEER to conduct construction review of the CONTRACTOR's performance does not, and is not intended to, include review of the adequacy of the CONTRACTOR's safety measures in, on, or near the construction site.

The CONTRACTOR shall comply with the safety standards provisions of applicable laws and building and construction codes. The CONTRACTOR shall exercise every precaution at all times for the prevention of accidents and protection of persons, including employees, and property. During the execution of the work the CONTRACTOR shall provide and maintain all guards, railing, lights, warnings, and other protective devices which are required by law or which are reasonably necessary for the protection of persons and property from injury or damage.

1.21 WARRANTY PERIOD

The CONTRACTOR shall warrant all furnished materials and equipment for a period of one (1) year from date of final acceptance of the Work by the OWNER. This warranty shall mean prompt attention to the correction and/or complete replacement of the faulty material or equipment. The expiration of the one-year warranty period shall not affect any other claims

or remedy available to the OWNER. There may be other warranty provisions in these contract documents in addition to those noted above.

1.22 UTILITY PROPERTIES AND SERVICE

In areas where the CONTRACTOR's operations are adjacent to or near a utility and such operations may cause damage which might result in significant expense, loss and inconvenience, the operations shall be suspended until all arrangements necessary for the protection thereof have been made by the CONTRACTOR.

The CONTRACTOR shall notify all utility offices which may be affected by the construction operation at least 48 hours in advance. Before exposing any utility, the utility having jurisdiction shall grant permission and may oversee the operation. Should service of any utility be interrupted due to the CONTRACTOR's operation, the proper authority shall be notified immediately. It is of the utmost importance that the CONTRACTOR cooperates with the said authority in restoring the service as promptly as possible. Any costs shall be borne by the CONTRACTOR.

Utilities which may be impacted include the following:

Lewis County	Water
L.C. PUD	Power
Century Link	Telephone

1.23 SANITARY FACILITIES

The CONTRACTOR shall provide and maintain sanitary facilities for its employees and its subcontractors' employees that will comply with the regulations of the local and State Departments of Health and as directed by the ENGINEER.

1.24 STREET CLEANUP

The CONTRACTOR shall clean daily all dirt, gravel, construction debris and other foreign material resulting from its operations from all streets and roads.

1.25 VEHICLE PARKING

The vehicles of the CONTRACTOR's and subcontractors' employees shall be parked in accordance with local parking ordinances.

1.26 PROTECTION OF QUALITY OF WATER

The work to be performed may involve connections to an existing potable water system. If such work is included in the project, the CONTRACTOR shall take such precautions as are necessary or as may be required to prevent the contamination of the water. Such contamination may include but shall not be limited to deleterious chemicals such as fuel,

cleaning agents, paint, demolition and construction debris, sandblasting residue, etc. In the event contamination does occur, the CONTRACTOR shall, at its own expense, perform such work as may be necessary to repair any damage or to clean the affected areas of the water mains to a condition satisfactory to the ENGINEER.

1.27 RECORD DRAWINGS

CONTRACTOR shall maintain at the site one set of specifications, full size drawings, shop drawings, equipment drawings and supplemental drawings which shall be corrected as the work progresses to show all changes made. Drawings shall be available for inspection by the ENGINEER. Upon completion of the contract and prior to final payment, specifications and drawings shall be turned over to the ENGINEER.

1.28 "OR EQUAL" CLAUSE

In order to establish a basis of quality, certain processes, types of machinery and equipment or kinds of material may be specified on the drawings or herein by designating a manufacturer's name and referring to its brand or product designation. It is not the intent of these specifications to exclude other processes, equipment or materials of a type and quality equal to those designated. When a manufacturer's name, brand or item designation is given, it shall be understood that the words "or equal" follow such name or designation, whether in fact they do so or not. If the CONTRACTOR desires to furnish items of equipment by manufacturers other than those specified, he shall secure the approval of the ENGINEER prior to placing a purchase order.

No extras will be allowed the CONTRACTOR for any changes required to adopt the substitute equipment. Therefore, the CONTRACTOR's proposal for an alternate shall include all costs for any modifications to the drawings, such as structural and foundation changes, additional piping or changes in piping, electrical changes or any other modifications which may be necessary or required for approval and adoption of the proposed alternate equipment. Approval of alternate equipment by the ENGINEER before or after bidding does not guarantee or imply that the alternate equipment will fit the design without modifications.

1.29 SURVEYS

Based upon the information provided by the Contract Documents, the CONTRACTOR shall develop and make all detail surveys necessary for layout and construction, including exact component location, working points, lines and elevations. Prior to construction, the field layout shall be approved by the OWNER's representative. The CONTRACTOR shall have the responsibility to carefully preserve bench marks, reference points and stakes, and in the case of destruction thereof by the CONTRACTOR or resulting from its negligence, the CONTRACTOR shall be charged with the expense and damage resulting therefore and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes.

1.30 DUST PREVENTION

All unpaved streets, roads, detours, haul roads or other areas where dust may be generated shall receive an approved dust-preventive treatment or be routinely watered to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.

Dust emissions from reservoir construction activities including sandblasting and painting shall be controlled to be within applicable environmental regulations. The CONTRACTOR shall be responsible for cleaning and repair of properties near the reservoir site which may become damaged by sandblasting or painting emissions.

1.31 EROSION AND SEDIMENTATION CONTROL

Temporary construction site erosion control measures shall be designed and constructed in accordance with the latest edition of the Stormwater Management Manual for Western Washington, available from the Washington Department of Ecology.

Erosion control measures shall be maintained throughout the project site until approved permanent cover such as a healthy stand of grass, other permanent vegetation, or other ground covering is established. When approved permanent ground cover is established, all temporary erosion control measures shall be removed from the construction site. Erosion control measures shall be installed as approved, per the erosion control drawing(s) in the above referenced document. Erosion control measures including stabilized construction entrances and sediment barriers must be established in conjunction with site clearing and grading.

During construction, and until permanent vegetation or other ground covering is established, the erosion control facilities shall be upgraded as needed for unexpected storm events or site conditions and with the purpose of retaining sediment and sediment-laden water on the construction site.

1.32 INTERFERENCES, OBSTRUCTIONS AND SEWER CROSSINGS

At certain places, power, light and telephone poles may interfere with excavation and the operation of the CONTRACTOR's equipment. Necessary arrangements shall be made with utility companies for moving or maintaining such poles. The utility company affected by any such interferences shall be notified thereof so that the necessary moving or proper care of poles and appurtenances may have appropriate attention.

All costs resulting from any other interferences and obstructions, or the replacement of such, whether or not herein specifically mentioned, shall be included and absorbed in the unit prices of the CONTRACTOR's bid.

1.33 NOISE LIMITATIONS

The project areas are located near a residential area. All applicable City, County ordinances

and State and Federal regulations shall be complied with.

1.34 STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS

A. Materials and equipment stored overnight shall be placed neatly on the job site. Unusable materials (i.e. rejected or damaged liner material, old concrete chunks, metal scraps, etc.) shall be expeditiously removed from the job site.

Provide appropriate barricades, signs, and traffic control devices in like-new condition where necessary to protect the public from any hazards associated with the storage of materials and equipment used for this project.

B. No equipment and/or materials shall be stored outside the immediate work area on public right-of-ways, in the following locations, or in the following manner:

1. In any maintained landscaped or lawn area.

2. In a manner that would totally eliminate an individual residents' street parking.

3. In front of any business.

The “immediate work area” is the area where work is taking place or will be taking place within one calendar day. The CONTRACTOR shall immediately move stored material or equipment which causes a nuisance or creates complaints.

1.35 COMPETENT PERSON DESIGNATION

CONTRACTOR shall designate a qualified and experienced “competent person” at the site whose duties and responsibilities shall include enforcement of Washington - OSHA regulations regarding excavations, the prevention of accidents, and the maintenance and supervision of construction site safety precautions and programs.

1.36 EMERGENCY MAINTENANCE SUPERVISOR

The CONTRACTOR shall submit to the ENGINEER the names, addresses and telephone numbers of at least two employees responsible for performing emergency maintenance and repairs when the CONTRACTOR is not working. These employees shall be designated, in writing by the CONTRACTOR, to act as its representatives and shall have full authority to act on its behalf. At least one of the designated employees shall be available for a telephone call any time an emergency arises.

1.37 USE OF EXPLOSIVES

The use of explosives shall not be allowed on this project. Alternative methods of excavation shall be utilized.

1.38 CONTAMINATED MATERIAL

A. General

It is possible that the CONTRACTOR may encounter contaminated material (soil and/or water) during excavation activities. This specification identifies requirements for handling and disposing contaminated media.

B. Definitions

1. “Contaminated material” is defined as soil, water, free product, Underground Storage Tanks (UST), buried abandoned utility lines containing residual or free product, solid waste, treated wood waste, chemical containers, or other solid, liquid, or gas substances with contamination levels above background levels.

2. “Hazardous substances” shall mean those substances or materials defined in the Washington Annotated Code (WAC) 173-303-040.

3. “Release” shall have the meaning as defined in WAC 173-303-040.

4. “Environmental laws” shall mean any applicable statute, law, ordinance, order, consent decree, judgment, permit, license, code, covenant, deed, common law, treaty, convention or other requirement pertaining to protection of the environment, health or safety, natural resources, conservation, wildlife, waste management or disposal, hazardous substances or pollution, including but not limited to regulation of releases to air, land, water, and groundwater.

C. Execution

1. Discovery of Contaminated Material

In the event that the CONTRACTOR, during the course of construction or during any other activities authorized under this contract, should encounter suspected contaminated material or any other materials suspected of posing a threat to human health and the environment, the CONTRACTOR shall notify the ENGINEER immediately and manage according to requirements identified below.

2. Discovery of Contaminated Soil

CONTRACTOR shall note evidence of contamination (odor, visual staining of soil, free liquid product seeping from soil, sheen on groundwater etc.) and note location of evidence on a sketch of the excavation and provide to the ENGINEER.

CONTRACTOR shall report the discovery to the ENGINEER immediately. CONTRACTOR shall stop all excavation activities, and secure the site to prevent entry by the public. The excavation shall not be backfilled. Protect all open

excavations with berms, plates and fencing. CONTRACTOR may continue with work in other non-contaminated areas.

CONTRACTOR shall assist ENGINEER in collecting sample(s) of suspected contaminated media for testing and characterization. CONTRACTOR shall allow 21 days, at no cost to OWNER, for testing, results and instructions as to how to proceed with contaminated materials.

The CONTRACTOR shall obtain a copy of an approved soil disposal/acceptance permit (Disposal/Treatment Facility requires transporter to have a copy of the permit.)

CONTRACTOR will transport and dispose of contaminated material at an approved disposal/treatment facility.

CONTRACTOR shall provide the ENGINEER with a copy of the contaminated soil disposal receipt.

3. Handling of Contaminated Soil

After approval from the ENGINEER, excavate the soil in a manner that prevents commingling of contaminated and non-contaminated soil. ENGINEER will make determination (based on soil saturation) if contaminated soil can be directly transported to a treatment or disposal facility, or if soil needs to be stockpiled to reduce water content. ENGINEER will determine when stockpiled soil can be transported off-site.

CONTRACTOR will be responsible for stockpiling contaminated soil in containers or on impervious surface to prevent the spread of contamination. Any water runoff from the contaminated soil stockpile area(s) must be contained by CONTRACTOR and handled as contaminated water.

Minimize movement of excavation equipment over or through contaminated soil to prevent movement of contaminated soil into areas where no contaminated soil exists.

Stockpiles will be created on an approved site and shall be surrounded by a fence to limit access. The stockpiles must be covered and bermed during periods of rainfall to prevent run-on and run-off. The stockpiles shall be covered with a minimum 10 mil high density polyethylene (HDPE) plastic during periods of strong winds, nightfall, over the weekends, or during extended work stoppages. If dust is observed coming from the stockpiles, the stockpiles shall be either covered or the dust controlled with water.

Maintain excavation equipment in good working order. Prevent spillage of oil, fuel, or hazardous substances from equipment. In particular, promptly repair oil leaks

from equipment and clean up any contaminated soil.

4. Transport of Contaminated Materials

CONTRACTOR shall comply with all applicable Federal, State, or local laws, codes, and ordinances that govern or regulate contaminated substance transportation. Contaminated soils placed in stockpiles shall be loaded into trucks in a manner that prevents the spilling or tracking of contaminated soil into areas of the site with uncontaminated soil. Loose material falling onto the exterior of the truck during loading shall be removed before the truck leaves the loading area. Any material collected in the loading area shall either be placed back into the truck or back into the stockpile. If loading areas are unpaved, the surface soil shall be sampled at the conclusion of the loading activities to confirm that contaminated soil is not present. If loading areas are paved, any loose soil shall be cleaned from the pavement at the conclusion of the loading activities.

Specific truck haul routes shall be established before beginning off-site contaminated media transport. On-site truck routes shall be established to minimize or prevent movement of trucks over contaminated soils. Off-site truck routes shall be established to reduce the risk of releases of contaminated soils and impact on local traffic. The CONTRACTOR shall be responsible for ensuring that loaded truck weights are within acceptable limits. All trucks shall be covered before they leave the loading area.

The CONTRACTOR shall ensure that all drivers of vehicles transporting contaminated substances have in their possession during transport all applicable Oregon State and local vehicle insurance requirements, valid driver's license, and vehicle registration and license. The CONTRACTOR shall be responsible for informing all drivers of transport vehicle about:

a. The nature of the material transported.

b. Required routes to and from the off-site thermal treatment or disposal facility.

c. Applicable County street regulations and requirements, and State of Oregon Department of Transportation codes, regulations and requirements.

d. The County's requirement for proper handling and transportation of the substances.

The CONTRACTOR shall not allow contaminated substances to be spilled or tracked off-site at any time during the project. Trucks used for the transportation of contaminated substances off-site shall be water tight, substance compatible, licensed, insured, and permitted pursuant to federal, state, and local statutes, rules, regulations and ordinances.

If contaminated media is discarded prior to removal of contaminated material, the price per cubic yard of soil materials and price per 100 gallons of contaminated water will be negotiated with OWNER.

1.39 FACILITY OPERATIONS REQUIREMENTS

The work included in these plans and specifications is to be performed on an existing municipal water treatment plant that must continue in operation during construction. The CONTRACTOR shall cooperate fully at all times with the OWNER and the ENGINEER to ensure that the production capability of the plant will continue and that any interruption to plant operations are minimized.

The specific major requirements for maintaining plant operations are listed below. These requirements are not necessarily complete in every detail:

A. Five (5) days' notice shall be given to the OWNER by the CONTRACTOR when any interruption of or modification to the operation of the existing plant and/or piping is desired.

B. Follow the sequence of construction requirements as described elsewhere in this section.

1.40 CONDITIONAL USE PERMIT

NOT USED

1.41 PROJECT INFORMATION SIGNS

The CONTRACTOR shall furnish and install project information signs in accordance with the following requirements:

A. For a project located on a confined site such as a reservoir, pumping station, well house, treatment plant, or similar facility, one project information sign shall be required. For a project located on a public right of way such as a pipeline project, a project information sign shall be installed facing each direction of traffic at each location where traffic is entering the work area. A minimum of two (2) signs will be required for pipeline projects.

B. A submittal for the project information sign(s) shall be prepared for the ENGINEER'S approval prior to fabrication.

C. The CONTRACTOR shall install the project information sign(s) at location(s) as directed by the ENGINEER.

D. No construction work shall commence on the project site until the project information sign(s) are installed.

E. The CONTRACTOR shall maintain the signs through the duration of the project.

The project information sign(s) shall be constructed of ¾-inch thick plywood with an APA finish grade of A-B, Exterior. The sign(s) shall be 48-inches high by 96-inches wide. The sign(s) shall be securely attached to two 4-inch square treated wood posts. The sign(s) shall be installed such that the top of the sign is approximately 10 feet above grade or as necessary to permit proper public viewing. The wood posts shall be buried at least 3 feet below grade. Provide adequate supports for the sign(s) as site conditions dictate. The sign(s) shall have black letters on a white background and they shall be the product of a commercial sign manufacturer or supplier. Logos shall be color. The letters shall be at least 4-inches in height.

The sign(s) will contain basic project information including: Project name, estimated project duration, project construction cost, project OWNER's name and OWNER's contact and phone number, ENGINEER's name, CONTRACTOR's name, OWNER's and ENGINEER's company logos, the CONTRACTOR's logo if the CONTRACTOR so desires, any funding agency logo(s) along with any required wording from those agencies. The logos shall be sized such that they are visible from a distance approved by the ENGINEER. The OWNER, ENGINEER and funding agencies (USDA and CDBG) will provide electronic images of their logos for the CONTRACTOR's use in developing the signs.

The sign shall follow the Temporary Construction Sign for Rural Development Projects template provided by USDA. A copy of the template is provided in Volume 1 of these documents.

1.42 WORK WITH EXISTING ASBESTOS WATER PIPELINES

The CONTRACTOR shall comply with all requirements of the State of Washington, Department of Ecology (DOE) with respect to the safe handling, removal and disposal of asbestos cement pipe, including all reporting requirements.

END OF SECTION

SECTION 01 22 20

UNIT PRICE MEASUREMENT AND PAYMENT

PART 1 GENERAL

Measurement and payment will be on a unit price basis in accordance with the prices set forth in the proposal for individual work items. Where work is required but does not appear as a separate item in the proposal, the cost for that work shall be included and absorbed in the unit prices named in the proposal. CONTRACTOR shall make a careful assessment when preparing the bid.

Vader-Enchanted Valley Reservoir

1. Mobilization, bonds, permitting, and insurance: Payment for mobilization, bonds, permitting, and insurance will be on a lump sum basis. The amounts paid for mobilization in the contract progress payment will be based on the percent of the original contract amount that is earned from other contract items, as follows:

   a. When 5% is earned, either 100% of the amount for mobilization or 5% of the original contract amount, whichever is the least.

   b. When all work is completed, amount of mobilization exceeding 5% of the original contract amount.

   This schedule of mobilization progress payments will not limit or preclude progress payments otherwise provided by the contract.

2. Minor Change: Measurement and payment for minor change will be the lump sum amount entered by the Owner in the bid proposal. Payment for minor contract changes will be made according to the provisions included in Section 1-04.4(1) of the Standard Specifications. Measurement will be based on a percentage of the total amount for approved minor change work.

3. Trench Safety System: Measurement and payment for trench safety system will be full pay for all costs necessary to install and maintain an adequate trench safety system, as required by the contract, and as specified herein at all locations where trench excavation exceeds a depth of four (4) feet. The safety system shall meet the requirements of the Washington Industrial Safety and Health Act, Chapter 49.17 RCW. Refer to Title 296 WAC, Part N for excavation, trenching and shoring requirements. Also included in this pay item is the requirement to notify the Washington Department of Labor and Industries [360-696-6317] one day prior to any trench excavation expected to exceed four feet in depth. The costs for trench safety system shall not be considered as incidental to any other contract item. *A "zero" or other unrealistic bid will be grounds to consider the entire bid as unresponsive.*

4. Construction survey and Staking: Measurement and payment for construction survey and staking will be made on a lump sum basis. The unit price shall be full payment for furnishing all manpower, materials, and equipment needed for a professional survey of latitude, longitude, and elevation data which will satisfy the contractor's requirements to effectively locate and place structures and earthwork elements.

5. Removal and replacement of unsuitable foundation materials: Measurement and payment for removal and replacement of unsuitable foundation materials will be made on a cubic yard basis. This is an anticipated bid item and will only be considered for payment as approved by the Engineer. The unit price shall be full payment for furnishing all manpower, materials and equipment for over-excavation, disposal, and replacement of unsuitable foundation material.

6. Erosion / water pollution control: Measurement and payment for erosion and water pollution control will be made on a lump sum basis. The unit price shall be full payment for furnishing all manpower, materials, and equipment needed to prevent any noticeable increases in turbidity of runoff from the site, removal of soils from the site, excess runoff from the site, and preventing channelization of exposed earth materials.

7. All work required to construct a new 250,000-gallon welded steel water storage reservoir, complete: Measurement and payment for all work required to construct a 250,000-gallon welded steel reservoir, complete, other than as provided for under separate unit prices, will be made on a single lump sum basis. General work categories are described in the price breakdown below, with the sum of items (A) through (E) below being equal to the total lump sum for Bid Item 7.

    a. Shop Drawings and approvals;

    b. Earthwork to include clearing and grubbing, mass excavation, stockpiling, hauling, backfilling and disposal of excess material offsite;

    c. Foundation French drain including solid drain line out to daylight;

    d. Reservoir construction including foundation rock backfill, concrete foundations, reservoir floor, reservoir shell, reservoir roof, interior piping, pipe blocks, access hatches, vents, roof handrail, ladders, fall prevention systems, interior and exterior surface preparation and coatings, and all other accessories as noted in the contract drawings and specifications;

    e. Reservoir testing, disinfection, and startup.

8. Final site grading and surface restoration: Measurement and payment for final site grading and surface restoration will be made on a lump sum basis. The unit price shall be full payment for furnishing all manpower, materials and equipment required for preparing the base material according to the plans, furnishing and installing soils as needed, and placing

the specified seed mixture and/or plants according to the supplier's recommendation. Final surface restoration includes restoring the newly created slopes associated with the new reservoir as well as the existing cut slope associated with the existing reservoir. Restoration limits shall be as shown on the Drawings.

9. Gravel surfacing: Measurement and payment for gravel surfacing will be made on a lump sum basis. The unit price shall be full payment for furnishing all manpower, materials and equipment required for preparing the base material and placing crushed rock, as specified, in the areas and location shown in the plans. The final grade of the rock must match the details as shown.

10. Furnish and install 3-inch diameter Schedule 80 PVC recirculation line, utility trench backfill (all depths): Measurement and payment for furnishing and installing Schedule 80 polyvinylchloride (PVC) pipe with utility trench backfill, including all work and materials, excavation to depths shown on the Drawings, all required joint restraint systems as applicable, standard concrete thrust blocks (including concrete, excavation, and thrust plates), pipe zone bedding, and trench backfill will be on a per linear foot basis regardless of depth. Measurement will be based on total length of piping constructed with joint types as indicated on the plans without deduction for fittings and valves. Pipe zone bedding material is understood to be imported granular material, compacted in place as shown on the plans. Trench backfill material shall be as shown on the Drawings and as specified within Section 31 23 17, Trenching.

11. Furnish and install Class 52 ductile iron water main, utility trench backfill (all depths): Measurement and payment for furnishing and installing Class 52 ductile iron (DI) pipe with utility trench backfill, including all work and materials, excavation to depths shown on the Drawings, all required joint restraint systems as applicable, standard concrete thrust blocks (including concrete, excavation, and thrust plates), pipe zone bedding, and trench backfill will be on a per linear foot basis regardless of depth. Measurement will be based on total length of piping constructed with joint types as indicated on the plans without deduction for fittings and valves. Pipe zone bedding material is understood to be imported granular material, compacted in place as shown on the plans. Trench backfill material shall be as shown on the Drawings and as specified within Section 31 23 17, Trenching.

12. Furnish and install cast or ductile iron pipe fittings: Measurement and payment for furnishing and installing cast or ductile iron fittings will be on a per each basis for the size and type shown on the Drawings including all required joint restraint systems as applicable. Fitting installation will be considered a separate pay item from work performed under other pay items. Fitting accessories including glands, bolts, and gaskets shall be considered incidental to the item.

13. Furnish and install buried valves: Measurement and payment for furnishing and installing buried valves not included in other pay items, including valve boxes, covers, grade pads, risers and extensions, if required, complete, will be on a per each basis for the size and type shown on the Drawings. Payment includes all required joint restraint systems.

14. Furnish and install flexible expansion joints: Measurement and payment for furnishing and installing flexible expansion joints shall be on a per each basis for the size and type shown on the Bid Proposal and shall include all trench excavation, pipe zone bedding and backfill material, and polyethylene material required for installation.

15. Connection to existing water main: Measurement and payment for connecting to existing water main, including exploratory excavation as may be required to confirm piping locations and type, any additional excavation and backfill, cutting existing piping, and all other miscellaneous tie-in related work not included in other pay items will be on a per each basis for the sizes and types as shown on the Bid Proposal.

16. Furnish and install valve vault, complete: Payment for furnishing and installing the valve vault, complete, as shown on the Drawings, shall be on a lump sum basis. Payment shall include all costs for labor and materials for delivering, assembly, excavation, compacted leveling pad, and backfill as specified. Also included in this bid item are the connections to the new pipeline and all work associated with installing the air / vacuum valve outside of the vault.

17. Furnish and Install yard hydrant assembly, complete: Measurement and payment for furnishing and installing yard hydrant assembly shall be on a per each basis for the size and type shown on the Drawings and shall include all trench excavation, materials, pipe zone bedding, and backfill material required for installation. Payment includes furnishing and installing the water service, isolation valves, and service piping as required for a fully functioning assembly.

18. Testing, flushing, and disinfection of water lines: Measurement and payment for testing, flushing, and disinfection of all water lines will be on a lump sum basis and shall include furnishing, installing and removing temporary blow-off piping, including miscellaneous piping, valves, fittings, and thrust restraint. The Owner shall provide off-site laboratory analysis. Payment for any retesting shall be paid by the Contractor.

19. Reservoir overflow splash pad and erosion control apron: Measurement and payment for the reservoir overflow splash pad and erosion control apron will be made on a lump sum basis. The lump sum price shall be full compensation for furnishing all labor and materials necessary to construct the reinforced concrete pad as illustrated in the Drawings, along with the quarry spalls erosion protection area downstream of concrete pad in the configuration and thickness shown in the Drawings.

20. Modifications to existing reservoir, complete: Measurement and payment for all work required to construct modifications to the existing reservoir, complete, other than as provided for under separate unit prices, will be made on a single lump sum basis. General work categories are described in the price breakdown below, with the sum of items (A) through (C) below being equal to the total lump sum for Bid Item 20.

    a. Clean existing reservoir – This item includes coordinating with the Vader Water System

to drain the existing reservoir, removal and disposal of sediment on the floor of the reservoir, and pressure washing of the reservoir interior.

b. Existing reservoir inlet connection – This item includes furnishing and installing the inlet connection as shown on the Drawings, including surface preparation, cutting, welding, and coating repairs as required.

c. Silt stop – This item includes furnishing and installing the silt stop with coatings as shown on the Drawings. Also included is surface preparation and cleaning of the existing piping being connected to.

21. All work required to construction a new raw water pump station, complete: Measurement and payment for all work required to construct a new raw water pump station, complete, other than as provided for under separate unit prices, will be made on a single lump sum basis. General work categories are described in the price breakdown below, with the sum of items (A) through (D) below being equal to the total lump sum for Bid Item 21.

    a. Reinforced concrete slab;

    b. Pump station with enclosure and control panel;

    c. Underground piping including fittings to connect the pump station to the site piping;

    d. System startup including training and O&M manuals

22. Realign water service connection, 1-inch diameter: Measurement and payment for an anticipated realignment of a water service line will be on a per each basis bid item and will only be considered for payment as approved by the Engineer. The unit price for service lines shall be full compensation for all service line work including excavation, hand excavation, backfill, surface restoration, all utility locates on private property, service pipe tubing, fittings, couplings, service saddles, corporation stops, unions, adapters, angle meter stops. Where applicable and indicated on the Drawings and in the Bid Proposal, payment shall also include all costs associated with backflow prevention devices, cleaning, disinfection, and installation. Costs will also include coordination with the Vader Water System and property owners. No additional payment will be made for special coordination with private property owners or permits for work on private property.

23. Site electrical, instrumentation control and telemetry: Measurement and payment for site electrical and instrumentation control will be made on a lump sum basis. The lump sum price shall be full compensation for furnishing all labor and materials necessary to install the control panel and associated equipment in the water treatment plant, buried conduit from the treatment plant to the reservoirs, above ground conduit on the reservoir, conductors, intrusion alarms, luminaires, and testing and startup as described in the specifications.

24. Construction project sign: Measurement and payment for construction project sign will be made on a lump sum basis. The lump sum price shall be full compensation for furnishing and installing project signs as described in the contract documents.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. This Section expands administrative and procedural requirements for submittals for review, information, and for Project closeout.

B. Section includes:

1. Contractor review.
2. Engineer review.
3. Submittal procedures.
4. Product data.
5. Shop Drawings.
6. Samples.
7. Design data.
8. Test reports.
9. Certificates.
10. Manufacturer's instructions.
11. Manufacturer's field reports.
12. Erection Drawings.
13. Construction progress schedules.
14. Breakdown of contract price (Schedule of Values).
15. Proposed product list.
16. Close out submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect/Engineer's responsive action.

B. Informational Submittals: Written and graphic information and physical Samples that do not require Architect/Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 CONTRACTOR REVIEW

A. Review for compliance with Contract Documents and approve submittals before transmitting to Engineer.

B. Contractor: Responsible for:

1. Determination and verification of materials including manufacturer's catalog numbers.

2. Determination and verification of field measurements and field construction criteria.

3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.

4. Determination of accuracy and completeness of dimensions and quantities.

5. Confirmation and coordination of dimensions and field conditions at Site.

6. Construction means, techniques, sequences, and procedures.

7. Safety precautions.

8. Coordination and performance of Work of all trades.

C. Stamp, sign or initial, and date each submittal to certify compliance with requirements of Contract Documents. Any submittals received by the Engineer which do not bear the Contractor’s approval or certification shall be returned without review.

D. When shop drawings and/or submittals are required to be revised or corrected and resubmitted, the Contractor shall make such revisions and/or corrections and resubmit those items or other materials in the same manner as specified above.

E. Regardless of corrections made in or review given to the drawings by the Engineer, the Contractor shall be responsible for the accuracy of such drawings and for their conformity to the Drawings and Specifications.

F. Do not fabricate products or begin Work for which submittals are required until approved submittals have been received from Architect/Engineer.

G. Materials and equipment shall be ordered a sufficient time in advance to allow time for reviews, and shall be available on the job when needed. Last minute review will not be given for inferior substitutes for material or equipment.

1.4 ENGINEER REVIEW

A. Do not make "mass submittals" to the Engineer. "Mass submittals" are defined as six or more submittals or items in one day or 20 or more submittals or items in one week. If "mass submittals" are received, Engineer's review time stated above will be extended

as necessary to perform proper review. Engineer will review "mass submittals" based on priority determined by Engineer after consultation with Owner and Contractor.

B. Informational submittals and other similar data are for Engineer's information, do not require Engineer's responsive action, and will not be reviewed or returned with comment.

C. The Engineer’s review of submittals and shop drawings is not a check of any dimension or quantity, and will not relieve the Contractor from responsibility for errors of any sort in the submittals and shop drawings.

D. Submittals made by Contractor that are not required by Contract Documents may be returned without action.

E. The Engineer will review the submitted data and shop drawings, and return to the Contractor with notations thereon indicating "No Exception Taken", "Make Corrections Noted", "Rejected", "Revise and Resubmit", or "Submit Specified Item".

F. Owner may withhold monies due to Contractor to cover additional costs beyond the second submittal review.

1.5 SUBMITTAL PROCEDURES

A. Transmit each submittal with CSI Form 12.1A - Submittal Transmittal or similar Engineer-accepted form.

B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

C. Show each Submittal with numbering and tracking system approved by Engineer:

1. Submittals shall be numbered according to specification section. For example, the first product submittal for Section 055000 would be “055000-1”. Resubmittals of that submittal would be “055000-1.1”, followed by “055000-1.2”, and so on. The second product submittal for that Section would be “055000-2”.

2. Submittals containing product information from multiple sections of the specifications will not be reviewed. Contractor and/or their supplier shall divide submittals in a manner that meets the numbering and tracking system requirements stated herein.

3. Alternative method of numbering may be accepted as approved by Engineer.

D. Identify: Project, Contractor, Subcontractor and supplier, pertinent Drawing and detail number, and Specification Section number appropriate to submittal.

E. Apply Contractor's stamp, signed or initialed, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is according to requirements of the Work and Contract Documents.

F. Schedule submittals to expedite Project, and submit electronic submittals via email as PDF electronic files.

G. Coordinate submission of related items.

1. All shop drawings for interrelated items shall be scheduled for submission at the same time.

2. The Engineer may hold shop drawings in cases where partial submission cannot be reviewed until the complete submission has been received or where shop drawings cannot be reviewed until correlated items affected by them have been received. When such shop drawings are held, the Engineer will advise the Contractor in writing that the shop drawing submitted will not be reviewed until shop drawings for all related items have been received.

H. When hard copies of submittals are provided by the Contractor, three (3) copies of all materials shall be provided to the Engineer. Two (2) copies of all submittals will be kept by the Engineer. If the Contractor requests that more than one (1) copy of the reviewed submittal be returned, then the Contractor shall submit the appropriate quantity of submittals.

I. For each submittal for review, allow not less than 14 working days for Engineer review, excluding delivery time to and from Contractor.

J. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.

K. Allow space on submittals for Contractor and Engineer review stamps or comments.

L. When revised for resubmission, the Contractor shall identify changes made since previous submission. A narrative of changes shall be provided, and shop drawings or calculations shall indicate that a revision was made.

M. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

N. Submittals not requested will not be recognized nor processed.

O. Incomplete Submittals: Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Engineer.

1.6 PRODUCT DATA

A. Product Data: Action Submittal: Submit to Engineer for review for assessing conformance with information given and design concept expressed in Contract Documents. Submitted data shall be sufficient in detail for determination of compliance with the Contract Documents.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

1. Note submittal will be returned to Contractor without review of submittal if products, models, options and other data are not clearly marked or identified.

C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents.

1.7 SHOP DRAWINGS

A. Shop Drawings: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional Engineer licensed in the state of Project responsible for designing components shown on Shop Drawings.

1. Include signed and sealed calculations to support design.

2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.

3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. Submit electronic submittals via email as PDF electronic files.

E. All dimensioned shop drawings shall be scalable and provided as full-sized (22” x 34”) sheets. PDF electronic files shall print as scalable full-sized sheets.

F. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents.

1.8 SAMPLES

A. Samples: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Samples for Selection as Specified in Product Sections:

1. Submit to Engineer for aesthetic, color, and finish selection.
2. Submit Samples of finishes, textures, and patterns for Owner selection.

C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.

D. Include identification on each Sample, with full Project information.

E. Submit number of Samples specified in individual Specification Sections; Engineer will retain one Sample.

F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.

G. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents.

1.9 DESIGN DATA

A. Informational Submittal: Submit data for Engineer's knowledge as Contract administrator or for Owner.

B. Submit information for assessing conformance with information given and design concept expressed in Contract Documents.

1.10 TEST REPORTS

A. Informational Submittal: Submit reports for Engineer's knowledge and records as Contract administrator or for Owner.

B. Submit test reports of information for assessing conformance with information given and design concept expressed in Contract Documents.

1.11 CERTIFICATES

A. Informational Submittal: Submit certification by manufacturer, installation/application Subcontractor, or Contractor to Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

1.12 MANUFACTURER'S INSTRUCTIONS

A. Informational Submittal: Submit manufacturer's installation instructions for Engineer's knowledge as Contract administrator or for Owner.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Engineer in quantities specified for Product Data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.13 MANUFACTURER'S FIELD REPORTS

A. Informational Submittal: Submit reports for Engineer's knowledge and records as Contract administrator or for Owner.

B. Submit report within 48 hours of observation to Engineer for information.

C. Submit reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.14 ERECTION DRAWINGS

A. Informational Submittal: Submit Drawings for Engineer's knowledge and records as Contract administrator or for Owner.

B. Submit Drawings for information assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Engineer or Owner.

PART 2 PRODUCTS

2.1 CONSTRUCTION PROGRESS SCHEDULES

A. Within fourteen (14) days after date of Notice to Proceed, prepare and submit to the Engineer a practicable schedule showing the order in which the Contractor proposes to carry out the Work, the dates on which the important features of the work will start, and the contemplated dates for completing same. In addition to a time-scaled bar chart schedule depicting the project critical path, the Contractor shall submit a detailed CPM logic diagram. The CPM diagram and time-scaled bar chart shall include the following:

- Construction activities
- Submittal and approval of material samples and shop drawings
- Procurement of critical materials
- Fabrication, installation, and testing of special material and equipment
- Duration of work, including completion times of all stages and their sub-phases

The activities shall be separately identifiable by coding or use of sub-networks or both. The duration of each activity shall be verifiable by manpower and equipment allocation, in common units of measure, or by delivery dates and shall be justifiable by the Contractor upon the request of the Engineer.

Detailed subnetworks will include all necessary activities and logic connectors to describe the work and all restrictions to it. In the restraints, include those activities from the project schedule which initiated the subnetwork as well as those restrained by it.

Include a tabulation of each activity in the computer mathematical analysis of the network diagram. Furnish the following information as a minimum for each activity:

- Event (node) number(s) for each activity
- Activity description
- Original duration of activities (in normal workdays)
- Estimated remaining duration of activities (in normal workdays)
- Earliest start date or actual start date (by calendar date)
- Earliest finish date or actual finish date (by calendar date)
- Latest start date (by calendar date)
- Latest finish date (by calendar date)
- Slack or float time (in workdays)

Computer printouts shall consist of at least a node sort and an “early start/total-float” sort.

B. Attention is drawn to typical local climatic weather patterns and Work shall be coordinated accordingly.

C. Complete project schedule shall be revised and resubmitted to the Engineer at a minimum occurrence of every two (2) weeks for review.

D. Three Week Lookahead Schedules: Provide each week at the weekly construction meeting. The previous week's completed work shall be shown on the schedule for a total of 4 weeks shown.

2.2 PROPOSED PRODUCT LIST

A. Within 14 days after date of Notice to Proceed, prepare and submit to the Engineer list of major products proposed for use, with name of manufacturer, supplier, trade name, subcontractor and model number of each product. Provide a schedule of specific target dates for the submission and return of shop drawings required by the contract documents.

B. For products specified only by reference standards, indicate manufacturer, trade name, model or catalog designation, and reference standards.

C. The list and schedule shall be updated and re-submitted when requested by the Engineer.

2.3 BREAKDOWN OF CONTRACT PRICE (SCHEDULE OF VALUES)

A. At or before the preconstruction meeting, submit a complete breakdown of all lump sum bid items showing the value assigned to each part of the work, including an allowance for profit and overhead adding up to the total lump sum contract price.

B. Breakdown of lump sum bids shall be coordinated with the items in the schedule and shall be in sufficient detail to serve as the basis for progress payments during construction.

C. Engineer will review the contract price breakdown and may request items to be further broken down or for more items be added in order to facilitate tracking of work progress for payment.

D. Preparatory work, bonds, and insurance required in setting up the job will be allowed as a separate entry on the cost breakdown but shall not exceed 5 percent of the total base bid.

E. Upon acceptance of the breakdown of the contract price by the Engineer, it shall be used as the basis for all requests for payment.

2.4 CONSTRUCTION PHOTOGRAPHS

NOT USED

2.5 CLOSE OUT SUBMITTALS

A. Operation and Maintenance (O&M) Instructions

1. Submit preliminary O&M materials for review by Engineer. These shall be submitted according to "Submittal Procedures" Article. The equipment manufacturer may furnish instruction manuals prepared specifically for the equipment furnished or standard manuals may be used if statements like "if your equipment has this accessory..." or listings of equipment not furnished are eliminated. O&M materials will be returned to the Contractor for resubmittal if the O&M materials do not clearly indicate what specific equipment was furnished and all items not provided being clearly crossed out. Poorly reproduced copies are not acceptable. Operation and maintenance instructions shall contain the following as a minimum:

   a. Approved shop drawings and submittal data;

   b. Model, type, size and serial numbers of equipment furnished;

   c. Equipment and driver nameplate data;

   d. List of parts showing replacement numbers;

   e. Recommended list of spare parts;

   f. Complete operating instructions including start-up, shutdown, adjustments, cleaning, etc.;

   g. Maintenance and repair requirements including frequency and detailed instructions; and

   h. Name, address and phone numbers of local representative and authorized repair service.

2. Following review and approval of the preliminary O&M materials by the Engineer and before acceptance of the Work, submit four (4) copies of complete final operation and maintenance instructions for all equipment supplied. Submit items in 8-1/2 x 11-inch heavy-duty three-ring binders when appropriate, or in 8-1/2 x 11-inch file folders. All binders and folders shall have clear plastic pockets on the front of the cover and the spine to allow for insertion of identifying information.

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 45 00

QUALITY CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers quality control requirements supplementary to those of the General Conditions and Technical Specifications.

1.2 PROVISIONS

A. Contractor's Responsibility for Testing

The CONTRACTOR shall be responsible for the cost of all testing as specified in this section. Additional information has been provided regarding the payment responsibility for the OWNER with regards to the Project.

B. OWNER's Right to Perform Additional Tests

The OWNER or ENGINEER reserves the right to complete additional testing. In such cases, the CONTRACTOR shall provide safe access for the OWNER or ENGINEER and their inspectors to adequately inspect the quality of work and the conformance with project specifications.

1.3 QUALITY ASSURANCE

A. Testing Requirements

An independently owned and operated laboratory approved by the ENGINEER shall perform all testing as specified herein.

B. Testing

1. General

a. All required testing of work and/or materials shall be conducted in the presence of the ENGINEER. The CONTRACTOR shall provide forty-eight (48) hour notification to the OWNER and OWNER's REPRESENTATIVE prior to conducting any and all quality assurance testing. Where applicable, work and materials shall only be buried with the consent of the ENGINEER.

b. Where such inspection and testing are to be conducted by an independent laboratory or agency, the sample or samples of material to be tested shall be

selected by such laboratory or agency or by the ENGINEER. The CONTRACTOR shall furnish such samples of all materials without charge to OWNER.

c. The results from any and all tests are made for the information of the OWNER. Regardless of any test results, the CONTRACTOR is solely responsible for the quality of workmanship and materials and for compliance with the requirements of the Drawings and Specifications.

2. Costs of Testing

a. The CONTRACTOR shall be responsible for and shall pay for all tests as specified in Part 3 of this Section. Additional information has been provided regarding the payment responsibility for the OWNER with regards to the Project.

b. With regards to all materials to be tested, where test results demonstrate that the material or workmanship does not meet the minimum requirements of the Contract Documents, additional testing shall be completed and shall be paid for by the CONTRACTOR with no reimbursement by the OWNER.

1.4 SPECIAL INSPECTIONS

Special inspections and testing as required by Chapter 17 of the IBC shall be conducted by OWNER-retained Special Inspectors and Testing Agencies as required and as indicated in the Contract Documents.

A. Special Inspectors and Testing Agencies Responsibilities

1. Verify that manufacturers maintain detailed fabrication and quality control procedures and review the completeness and adequacy of those procedures to perform the Work.

2. Promptly notify OWNER and CONTRACTOR of irregularities and deficiencies observed in the Work during performance of their services.

3. Submit certified written report of each test, inspection and similar quality control service to OWNER, CONTRACTOR and jurisdictional authorities. Interpret test results and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

4. Submit final report of special inspections at Substantial Completion, including a list of unresolved deficiencies.

5. Re-test and re-inspect corrected work.

B. CONTRACTOR'S Responsibilities

1. Provide quality requirements to all subcontractors and enforce all requirements.

2. Notify OWNER, ENGINEER, Special Inspectors and Testing Agencies at least 48 hours in advance of time when Work that requires testing or special inspecting will be performed, unless otherwise indicated in the Contract Documents.

3. Pay for any CONTRACTOR requested testing and inspecting not required by the Contract Documents.

4. Pay for any re-testing or re-inspections by Special Inspectors and Testing Agencies for replacement work resulting from work that failed to comply with the Contract Documents. OWNER will deduct such costs from the Contract Price.

5. Submit copies of licenses, certifications, correspondence, records and similar documents used to establish compliance with standards and regulations that pertain to performance of the Work to the OWNER, ENGINEER and Special Inspectors.

6. Where Special Inspection requires pre-construction testing for compliance with specified requirements for performance and test methods, comply with the following:

    a. Provide test specimens representative of proposed products and construction in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

    b. Provide information on configurations of test assemblies, testing procedures and laboratory test records to adequately demonstrate capability of products to comply with performance requirements.

7. Cooperate with Agencies performing required tests, special inspections and similar quality control services. Notify Agencies in advance of operations to permit assignment of personnel. Provide the following:

    a. Access to the Work.

    b. Incidental labor, equipment and materials necessary to facilitate tests and special inspections.

    c. Adequate quantities of representative samples of materials that require testing and inspecting. Assist Agencies in obtaining samples.

    d. Provide facilities for storage and field curing of test samples.

e. Deliver samples to Testing Agencies.

8. Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and special inspecting.

9. Schedule times for tests, special inspections, obtaining samples and similar activities. Distribute schedule to OWNER, ENGINEER, Special Inspectors, Testing Agencies and each party involved in portions of the work where tests and special inspections are required.

1.5 SUBMITTALS

A. Laboratory Test or Inspection Reports

Each report shall be signed and certified by the independently owned and operated testing laboratory. Unless otherwise specified, submit three (3) copies of each report to the OWNER or OWNER's REPRESENTATIVE.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 FIELD TESTING SCHEDULE

A. The CONTRACTOR shall complete field testing in accordance with the following schedule. Additional source material testing shall be completed as necessary to establish the basis of field tests. The frequency of testing listed in this schedule lists the minimum number of tests per quantity of work completed by the CONTRACTOR. Testing locations to be determined by the ENGINEER.

Material to be Tested	Payment Responsibility for Initial Testing	Minimum Testing Frequency
Subgrade / Foundation Preparation	OWNER	In-place compaction testing (w/ nuclear compaction gage) performed at subgrade, three tests per 2,500 sf of prepared area, minimum of five tests total.
Structural Backfill	OWNER	In-place compaction testing (w/ nuclear compaction gage) performed at 2-foot elevation increments, three tests per 2,500 sf of material placed, minimum of five tests total. See Article 3.5, Field Quality Control of Section 31 23 23, Fill for further details on testing requirements.
Trench Backfill	CONTRACTOR	In-place compaction testing (w/ nuclear compaction gage) performed at 2-foot elevation increments, three tests per 200 linear feet of pipeline trench as measured along pipe centerline. ENGINEER may reduce frequency to one test per lift for every 1,500 linear feet of pipeline trench when satisfied with CONTRACTOR's method of compaction. See Article 3.16, Field Quality Control of Section 31 23 17, Trenching for further details.
Asphalt Concrete	CONTRACTOR	As required when placed. See detailed requirements in Article 3.3, Field Quality Control of Section 32 12 16, Asphalt Paving.
Concrete	OWNER	As required when placed. See detailed requirements in Article 3.12, Concrete Tests of Section 03 11 00, Concrete Work.
Grout	OWNER	Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the ENGINEER to insure continued compliance with Specifications. See detailed requirements in Article 3.2, Field Quality Control of Section 03 60 00, Grouting.

Material to be Tested	Payment Responsibility	Minimum Testing Frequency
Waterline – Hydrostatic testing and disinfection	CONTRACTOR	As required. See Section 33 13 00, Testing & Disinfection of Water Utility Piping.
Reservoir – Disinfection	CONTRACTOR	As required. See Section 33 13 13, Disinfection of Water Utility Storage Tanks
Reservoir – VOC	OWNER	As required. See Section 33 13 13, Disinfection of Water Utility Storage Tanks
Reservoir –Testing and repair of leaks	CONTRACTOR	As required. See Section 33 16 13.13, Steel Aboveground Water Utility Storage Tanks.

END OF SECTION

SECTION 01 75 16

TESTING, TRAINING AND SYSTEM START-UP

PART 1 GENERAL

1.1 SCOPE

This section specifies equipment and system testing and start-up, services of manufacturer's representatives, training of OWNER's personnel and final testing requirements for the complete facility.

1.2 CONTRACT REQUIREMENTS

A. Testing, training and start-up are requisite to the satisfactory completion of the Contract.

B. Complete all testing, training, and start-up within the Contract Time(s).

C. Furnish all necessary labor, power, chemicals, tools, equipment, instruments, and services required for and incidental to completing functional testing, performance testing, and operational testing.

D. Provide competent, experienced technical representatives of equipment manufacturers for assembly, installation, testing, and operator training.

1.3 START-UP PLAN

A. Submit start-up plan for each piece of equipment and each system not less than two (2) weeks prior to planned initial equipment or system start-up.

B. Provide detailed Start-up Progress Schedule with the following activities identified:

1. Manufacturer’s services
2. Installation certifications
3. Operator training
4. Submission of operation and maintenance manual
5. Functional testing
6. Performance testing
7. Operational testing

C. Provide testing plan with test logs for each item of equipment and/or system. Include testing of alarms, control circuits, capacities, speeds, flows, pressures, vibrations, sound levels, and other parameters.

D. Provide summary of shutdown requirements for existing systems if required, which are necessary to complete start-up of new equipment and systems.

E. Revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

1.4 GENERAL START-UP AND TESTING PROCEDURES

A. Mechanical Systems:

1. Remove rust preventatives and oils applied to protect equipment during construction.

2. Flush lubrication systems and dispose of flushing oils. Recharge lubrication system with lubricant recommended by manufacturer.

3. Flush fuel system and provide fuel for testing and start-up.

4. Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.

5. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.

6. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.

7. Perform cold alignment and hot alignment to manufacturer's tolerances.

8. Adjust V-belt tension and variable pitch sheaves.

9. Inspect hand and motorized valves for proper adjustment. Tighten packing glands to insure no leakage, but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.

10. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.

11. Install gratings, safety chains, handrails, shaft guards and sidewalks prior to operational testing.

B. Electrical Systems

1. Perform insulation resistance tests on wiring except 120-volt lighting, wiring, and control wiring inside electrical panels.

2. Perform continuity tests on grounding systems.

3. Test and set switchgear and circuit breaker relays for proper operation.

4. Perform direct current high potential tests on all cables that will operate at more than 2,000 volts. Obtain services of independent testing lab to perform tests.

5. Check motors for actual full load amperage draw. Compare to nameplate value.

C. Instrumentation Systems

1. Bench or field calibrate instruments and make required adjustments and control point settings.

2. Leak test pneumatic controls and instrument air piping.

3. Energize transmitting and control signal systems, verify proper operation, ranges and settings.

1.5 FUNCTIONAL TESTING

A. Functionally test mechanical and electrical equipment for proper operation after general start-up and testing tasks have been completed.

B. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.

C. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.

D. Conduct continuous 8-hour test under full load conditions. Replace parts which operate improperly.

1.6 CERTIFICATE OF PROPER INSTALLATION

A. At completion of functional testing, furnish written report prepared and signed by manufacturer's authorized representative, certifying equipment:

1. Has been properly installed, aligned, adjusted and lubricated.

2. Is free of any stresses imposed by connecting piping or anchor bolts.

3. Is suitable for satisfactory full-time operation under full load conditions.

4. Operates within the allowable limits for vibration.

5. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.

6. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly functioning.

B. Furnish written report prepared and signed by the electrical and/or instrumentation subcontractor certifying:

1. Motor control logic that resides in motor control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation subcontractor has been calibrated and tested and is properly operating.

2. Control logic for equipment start-up, shutdown, sequencing, interlocks and emergency shutdown has been tested and is properly operating.

C. Co-sign the reports along with the manufacturer's representative and subcontractors.

1.7 TRAINING OF OWNER'S PERSONNEL

A. Provide operations and maintenance training for items of mechanical, electrical and instrumentation equipment. Utilize manufacturer's representatives to conduct training sessions.

B. Coordinate training schedule with City staff. Coordinate training sessions to prevent overlapping sessions. Arrange sessions so that individual operators and maintenance technicians do not attend more than two (2) sessions per week.

C. Provide Operation and Maintenance Manual for specific pieces of equipment or systems two (2) weeks prior to training session for that piece of equipment or system.

D. Satisfactorily complete functional testing before beginning operator training.

E. The OWNER may videotape the training for later use with the OWNER's personnel.

1.8 MINIMUM SERVICE SCHEDULE

Minimum services as specified shall be provided in accordance with the following schedule:

Specification Section	Equipment	Minimum On-Site Time Requirements		
		1) Equipment Installation	2) Equipment Testing	3) Operator Training
33 12 23	Pump Station	2 CWD	3 CWD	1 CWD

NOTE: CWD is defined as a consecutive working day consisting of 8 hours each from 8:00 a.m. to 5:00 p.m.

1.9 OPERATIONAL TESTING

A. Conduct operational test of the entire facility after completion of operator training. Demonstrate satisfactory operation of equipment and systems in actual operation.

B. Conduct operational test for continuous seven (7) day period.

C. Owner will provide operations personnel, power, fuel, and other consumables for duration of test.

D. Immediately correct defects in material, workmanship, or equipment which became evident during operational test.

E. Repeat operational test when malfunctions or deficiencies cause shutdown or partial operation of the facility or results in performance that is less than specified.

1.10 RECORD KEEPING

A. Maintain and submit to ENGINEER the following records generated during start-up and testing phase of project:

1. Daily logs of equipment testing identifying all tests conducted and outcome.

2. Logs of time spent by manufacturer's representatives performing services on the job site.

3. Equipment lubrication records.

4. Electrical phase, voltage, and amperage measurements.

5. Insulation resistance measurements.

6. Pump torsional and lateral vibration analysis report.

7. Data sheets of control loop testing including testing and calibration of instrumentation devices and set-points.

END OF SECTION

SECTION 02 30 00

SUBSURFACE INVESTIGATION

PART 1 GENERAL

1.1 SUMMARY

A. Subsurface investigations and reporting have been performed for the purpose of obtaining data for the planning and design of this project. Copies of such reporting are attached to the Contract Documents as Supplementary Information.

1.2 LIMITATIONS

A. The subsurface investigations and reporting are being made available solely for the convenience of the Bidder and shall not relieve the Bidder or the Contractor of any risk, duty to make examinations and investigations as required by Article 4 of the Instructions to Bidders, or any other responsibility under the Contract Documents.

B. It is mutually agreed to by all parties:

1. Written reports are reference documents and are not part of the Contract Documents.

2. Subsurface investigations are for the purpose of obtaining data for planning and design of the project.

3. Data concerning borings and test pits is intended to represent with reasonable accuracy conditions and material found in specific borings and test pits at the time the borings and test pits were made.

C. It is expressly understood and agreed the Owner and Engineer assume no responsibility whatsoever in respect to the sufficiency or accuracy of the investigation thus made, the records thereof, or of the interpretations set forth therein, or made by the Owner in his use thereof; and there is no warranty or guarantee, either expressed or implied, that the conditions indicated by such investigations, or records thereof, are representative of those existing throughout such areas, or any part, or that unforeseen developments may not occur.

D. The Owner’s subsurface investigations and reporting are made available to Bidder or Contractor only on the basis of the understandings and agreement herein stated.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 03 11 00

CONCRETE WORK

PART 1 GENERAL

1.1 SUMMARY

A. The extent of concrete work is shown on the Drawings.

B. Work includes providing formwork and shoring for cast-in-place concrete and installation into formwork of items such as reinforcing steel bar (rebar), anchor bolts, setting plates, bearing plates, anchorages, inserts, reveals, frames, nosings, sleeves and other items to be embedded in concrete.

1.2 QUALITY ASSURANCE

A. Codes and Standards

Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified here:

ACI 301 “Specifications for Structural Concrete for Buildings”

ACI 311 “Recommended Practice for Concrete Inspection”

ACI 318 “Building Code Requirements for Reinforced Concrete”

ACI 347 “Recommended Practice for Concrete Formwork”

ACI 304 “Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete”

Concrete Reinforcing Steel Institute, “Manual of Standard Practice”

Comply with building code requirements which are more stringent than the above and all OSHA requirements.

B. American Society for Testing and Materials (ASTM)

1. C31, Making and Curing Concrete Test Specimens in the Field.

2. C33, Specification for Concrete Aggregate.

3. C39, Compressive Strength of Cylindrical Concrete Specimens.

4. C40, Organic Impurities in Fine Aggregate for Concrete.

5. C85, Cement Content of Hardened Portland Cement Concrete.

6. C88, Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.

7. C94, Standard Specifications for Ready-Mixed Concrete.

8. C131, Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

9. C136, Method for Sieve Analysis to Fine and Coarse Aggregate.

10. C143, Slump of Portland Cement Concrete.

11. C150, Standard Specification for Portland Cement.

12. C156, Water Retention by Concrete Curing Materials.

13. C173, Air Content of Freshly Mixed Concrete by the Volumetric Method.

14. C231, Air Content of Freshly Mixed Concrete by the Pressure Method.

15. C233, Standard Method of Testing Air-Entraining Admixtures for Concrete.

16. C260, Standard Specifications for Air-Entraining Admixtures for Concrete.

17. C289, Standard Test Method for Potential Reactivity of Aggregates (Chemical Method).

18. C441, Standard Test Method for Effectiveness of Mineral Admixtures in Preventing Excessive Expansion of Concrete Due to the Alkali-Aggregate Reaction.

19. C457, Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete.

20. C494, Standard Specifications for Chemical Admixtures for Concrete.

21. C670, Preparing Precision Statements for Test Methods for Construction Materials.

22. C803, Penetration Resistance of Hardened Concrete.

C. Workmanship

The CONTRACTOR is responsible for correction of concrete work that does not conform to the specified requirements, including strength, tolerances and finishes. Correct deficient concrete as directed by the ENGINEER. The CONTRACTOR shall also be

responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

D. Concrete Testing Service

The OWNER or a representative of the OWNER will engage a special inspector/testing laboratory to perform material evaluation tests and to design concrete mixes. See detailed requirements in Part 3.14 “Quality Control Testing during Construction”. Per the OWNER or ENGINEER’s requirements the CONTRACTOR shall notify the designated representative to schedule the special inspections and materials testing required by the project documents.

E. Testing Requirements

Materials and installed work may require testing and retesting, as directed by the ENGINEER, at anytime during the progress of the work. Allow free access to material stockpiles and facilities at all times. All testing, including the retesting of rejected materials and installed work shall be done at the CONTRACTOR’s expense.

F. Tests for Concrete Materials

1. Test aggregates by the methods of sampling and testing of ASTM C33.

2. For Portland cement, sample the cement and determine the properties by the methods of test of ASTM C150.

3. Submit written reports to the ENGINEER, for each material sampled and tested prior to the start of work. Provide the project identification name and number, date of report, name of CONTRACTOR, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

4. Certificates of material properties and compliance with specified requirements may be submitted in lieu of testing. The materials producer and the CONTRACTOR must sign certificates of compliance.

G. Allowable Tolerances:

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347, and as follows:

   a. Variation from plumb in lines and surfaces of columns, piers, walls and rises; 1/4-inch per 10 feet, but not more than 1-inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum; 1/2-inch maximum in 40 feet or more.

b. Variation from level or grade in slab soffits, ceilings, beam soffits, and rises 1/4-inch in 10 feet, 3/8-inch in any bay or 20 feet maximum, and 3/4-inch in 40 feet or more. For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum and 1/2-inch in 40 feet or more.

c. Variation from position of the linear lines and related columns, walls, and partitions, 1/2-inch in any bay or 20 feet maximum, and 1-inch in 40 feet or more.

d. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4-inch.

e. Variation in cross-sectional dimensions of columns and beams and thickness of slabs and walls, minus 1/4-inch and plus 1/2-inch.

f. Variations in footing plan dimensions, minus 1/2-inch and plus two (2) inches; misplacement or eccentricity, two (2) percent of the footing width in direction of misplacement but not more than two (2) inches; thickness reduction, minus five (5) percent.

g. Variation in steps - In a flight of stairs, 1/8-inch for rise and 1/4-inch for treads; in consecutive steps, 1/16-inch for rise and 1/8-inch for treads.

h. Circular structures shall be constructed in a true circular form, with maximum variation of 1/4-inch from the dimensions shown on the plans.

2. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

3. During concrete placement check formwork and related supports to ensure that forms are not displaced, and that completed work will be within specified tolerances.

H. Quality Control Testing During Construction

See Section 3 - Execution.

1.3 SUBMITTALS

A. For information only, submit six (6) copies of manufacturer's data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water stops, joint systems, chemical floor hardeners, dry-shake finish materials, and others. Bind and submit in one submittal.

B. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with the ACE 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures” showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

C. Submit shop drawings for fabrication and erection of specific finished concrete surfaces as shown or specified. Show the general construction of forms including jointing, special formed joints or reveals, location and pattern of form tie placement, and other items which affect the exposed concrete visually. Submit form drawings for building columns, walls, fascias, and intersections, and concrete pan and joist system. Submit for typical sections only. ENGINEER’s review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is the CONTRACTOR’s responsibility.

D. Submit six (6) copies of laboratory test reports for concrete materials and mix design tests as specified.

E. Material Certificates may be provided in lieu of materials laboratory test reports. The material manufacturer and the CONTRACTOR, certifying that each material item complies with, or exceeds, the specified requirements shall sign material certificates.

1.4 CONCRETE MIX DESIGNS

A. All concrete materials shall be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

B. If the concrete mix designs specified herein have not been used previously by the ready-mix supplier or if directed by the ENGINEER, mix proportions and concrete strength curves for regular cylinder tests, based on the relationship of 7, 14 and 28 day strengths versus slump values of two (2), four (4), and six (6) inches, all conforming to these Specifications, shall be established by an approved ready-mix supplier or an independent testing laboratory. A laboratory, independent of the ready-mix supplier, shall be required to prepare and test all concrete cylinders. The costs for preparation of mix designs (if required by the OWNER to be performed by an independent testing laboratory) and testing of concrete and materials shall be borne by the OWNER, except when materials do not meet specified requirements, in which case such costs shall be borne by the CONTRACTOR.

C. The exact proportions by weight of all materials entering into the concrete delivered to the jobsite shall conform to the approved mix design unless specifically so directed by the ENGINEER or Laboratory for improved specified strength or desired density, uniformity and workability.

D. The proportions of such mix design shall be based on a full cubic yard of hardened concrete.

E. Ready-mix companies or jobsite batch plants shall furnish delivery tickets, signed by a Certified Weighmaster, on which each shall state the weight of aggregates, sand, cement, admixtures and water and the number of cubic yards of concrete furnished, which will be compared against the approved mix design.

F. There shall be no variation in the weights and proportions of materials from the approved mix design.

G. There shall be no variation in the quality and source of materials once they have been approved for the specific mix design.

1.5 READY-MIXED CONCRETE

Ready-mixed concrete shall conform to the requirements of ACI 301 and ASTM C 94. In case of conflict, ACI 301 shall govern.

1.6 SAMPLE

CONTRACTOR shall pour and finish one 2-foot square exposed aggregate concrete sample for ENGINEER's approval prior to construction if exposed aggregate is included on job.

1.7 JOB CONDITIONS

Maintain continuous traffic control and access for vehicular and pedestrian traffic as required for other construction activities as well as to adjoining facilities for regular operation. Utilize flagmen, barricades, warning signs and warning lights as required, to maintain a safe entrance and passage on all roads or drives abutting the project.

PART 2 PRODUCTS

2.1 WALL FORMS

A. Full Height Pours: The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

B. Wall Form Ties

1. Form ties which remain in the wall of a subgrade water-retaining structure shall have waterstops and a one-inch minimum breakback or cone depth.

2. Snap ties, if used, shall not be broken until the concrete has reached the design concrete strength. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used. The use of tie wires as form ties will not be permitted. Fully threaded stub bolts may be used in lieu of smooth ties with waterstops.

3. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical recess made therefore in the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess. Plugs shall be A-58 SURE PLUG as manufactured by DAYTON SUPERIOR, Santa Fe Springs, CA; phone: (714) 522-3442.

4. Ties shall positively secure the wall to the required dimension and hold the wall to that dimension prior to and during concrete placement.

C. Wall Form Stiffeners

1. Horizontal walers shall consist of structural steel channels, angles or tubing of adequate size to retain the concrete without deflecting.

2. The walers shall be rolled or welded to the proper radii or offset brackets shall be used for shaping the wall to the dimensions shown on the Drawings and shall be used both for inside and outside wall forms in direct contact with the wall panels and at vertical spacings of no more than 96 inches on center.

3. There shall be at least one such waler within 24 inches of the top and bottom of the wall.

4. The largest dimension of the steel waler shall be in the radial direction.

5. Vertical structural steel or wood members shall be used at a minimum horizontal spacing of 74 inches and shall have sufficient rigidity and strength to insure the proper vertical alignments with the aid of braces under all predictable stress conditions.

6. In lieu of the above, a different system and spacings may be used if it is satisfactorily demonstrated to the ENGINEER that it will be equally effective.

2.2 FORMS FOR EXPOSED FINISH CONCRETE

Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Finish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection. Use overlaid plywood complying with U.S. Product Standard PS-

1 “B-B High Density Overlaid Concrete Form”, Class I. Use flexible spring steel forms or laminated boards free of distortion and defects to form radius bends as required.

2.3 FORMS FOR UNEXPOSED FINISH CONCRETE

A. Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least two (2) edges and one (1) side for tight fit.

2.4 FORM MATERIALS

A. Form Coatings

Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compound. Petroleum based coatings shall not be used for structures in creeks and waterways. Biodegradable coatings shall be used which will not contaminate the creeks/waterways or an alternate method for stripping the form shall be proposed.

B. Chamfers, Reveals, Drips

Provide preformed PVC or shaped wood or metal of size and profile as shown on drawings.

C. Cylindrical Columns and Supports

Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation. Provide units having “seamless” interior to minimize spiral gaps or seams.

D. Pan Forms

Provide forms for concrete pan-type construction complete with covers and end enclosures to form a true, clean, smooth concrete surface. Design units for easy removal without damaging placed concrete. Block adjoining pan units if required to avoid lateral deflection of formwork during concrete placement and compaction. Provide standard or tapered end forms, as shown.

If required, factory-fabricate pan form units to required sizes and shapes of the following:

1. Steel - 16 gauge minimum, free of dents, irregularities, sag and rust, or

2. Glass-Fiber Reinforced Plastic - Molded under pressure with matched dies, 0.11 inches minimum wall thickness.

E. Inserts

Provide metal inserts for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work. Provide “Parabolt” by the Molly Company, “Phillips Red-Head”, or “Burke” products. The CONTRACTOR is responsible for insuring that all required anchorage not specified in the project documents is installed per current building code and applicable ICC report requirements.

2.5 REINFORCING MATERIALS

A. Reinforcing Bar (rebar): ASTM A615 and as follows below>

Stirrups and Ties	Grade 60 (Grade 40 may be used for #3 and smaller)
All other Uses	Grade 60

B. Steel Wire: ASTM A82, plain, cold-drawn, steel.

C. Welded Wire Fabric (WWF): ASTM A185, welded steel wire fabric.

D. Supports for Reinforcement

Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise specified. Wood, brick, concrete blocks and other devices will not be acceptable. For slabs-on-grade, use supports with sand plates or horizontal runners where wetted base materials will not support chair legs. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are hot-dip galvanized, after fabrication, or plastic protected or stainless steel protected.

E. Fiber Reinforcement – Collated polypropylene fiber, ¾”-inch, manufactured from 100% virgin homopolymer polypropylene, hydrophobic, in compliance with ASTM C116.

2.6 CONCRETE MATERIALS

A. Portland Cement

ASTM C150, Type II, unless otherwise acceptable to ENGINEER. Use only one (1) brand of cement throughout the project, unless otherwise acceptable to the ENGINEER. The use of ground granulated blast furnace slag is not allowed.

B. Aggregates

ASTM C33 and as herein specified. Provide aggregates from a single source for all exposed concrete.

Local aggregates not complying with ASTM C33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the ENGINEER.

1. Fine Aggregate - Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank-run sand and manufactured sand are not acceptable.

2. Coarse Aggregate - Clean, uncoated, processed aggregate containing no clay, mud, loam or foreign matter, as follows:

   a. Crushed stone processed from natural rock or stone.

   b. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.

   c. Maximum Aggregate Size - Not larger than one-fifth (1/5) of the narrowest dimensions between sides of forms, one-third (1/3) of the depth of slabs, nor three-fourths (3/4) of the minimum clear space between individual reinforcing bars or bundles of bars.

3. These limitations may be waived if, in the judgment of the ENGINEER, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids.

4. In general it is desired that normal commercial mixes using 1-1/2-inch or 3/4-inch maximum aggregate size be used.

5. Aggregate for exposed aggregate concrete shall consist of selected aggregate of washed clean river gravel in color range of medium to dark in browns and grays; material uniformly sized 5/8-inch to 3/4-inch.

C. Water: Clean, fresh, drinkable.

D. Air Entraining Admixture: ASTM C260.

E. Water-Reducing Admixture: ASTM C494, Type A.

F. Set-Control Admixtures: ASTM C494, as follows:

1. Type B, Retarding.

2. Type C, Accelerating.
3. Type D, Water-reducing and Retarding.
4. Type E, Water-reducing and Accelerating.

Calcium chloride will not be permitted in concrete, unless otherwise authorized in writing by the ENGINEER.

2.7 RELATED MATERIALS

A. Waterstops

Provide flat, dumbbell type or centerbulb type waterstops at construction joints and other joints as shown. Size to suit joints or as shown. Provide PVC waterstops complying with Corps of Engineer's CRD-C 572. Waterstops to be Greenstreak 701 or approved equal. Split face waterstops will not be acceptable under any circumstances.

B. Bituminous and Fiber Joint Filler

Provide resilient and non-extruding type premolded bituminous impregnated fiberboard units complying with ASTM D1751, FS HH-F-341, Type 1 and AASHTO M 213. Provide one of the following products:

1. Elastite; Philip Carey/Celotex
2. Flexcell; Celotex Corp.
3. Crane Fiber 1390; W.R. Grace & Co.
4. Fibre; W.R. Meadows, Inc.
5. Tex-Lite; J & P Petroleum Prod. Inc.
6. Sonoflex; Sonneborn/Contech, Inc.

C. Joint Sealing Compound: See Section 07 92 00, Joint Sealants.

D. Moisture Barrier

Provide moisture barrier cover over all prepared base material. Use only materials that are resistant to decay when tested in accordance with ASTM E154. The moisture barrier consists of heavy Kraft papers laminated together with glass fiber reinforcement and overcoated with black polyethylene on each side. Provide Moistop, St. Regis, or equal.

E. Form Ties (for forms other than wall forms)

Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. Unless otherwise shown, provide ties so portion remaining within concrete after removal is at least 1-1/2 inches inside concrete. Unless otherwise shown, provide form ties, which will not leave holes larger than 1-inch in diameter in concrete surface.

F. Concrete Curing Materials

Acrylic curing and sealing compound - Water emulsion acrylic curing and sealing compound formulated of acrylic polymers of water based carrier. W.R. Meadows, Inc. VOCOMP-20 or approved equal.

G. Epoxy Adhesive

Provide Sikadur Hi-Mod (Sikastik 370) or Sikadur Hi-Mod Gel (Sikastix 390) for application to wire-brushed and prepared existing concrete to be mated to new concrete. Apply per manufacturer's recommendations.

H. Chemical-Hardener Finish: Provide Hornolith from Tamms Industries, or approved equal.

I. Non-slip Aggregate Finish

Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof and non-glazing, and is unaffected by freezing, moisture and cleaning materials.

J. Non-shrink Grout: See Section 03 60 00, Grouting.

2.8 PROPORTIONING NORMAL CONCRETE

A. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1. All measurements shall be by weight. All concrete admixtures will either be by the same supplier to insure compatibility. If different suppliers are used a memorandum from EACH admixture supplier will be provided stating the compatibility of their product with the other supplier's products.

B. The slump shall be between two inches and four inches when tested in accordance with ASTM Specifications C 143. Variations in the slump range may be allowed by the ENGINEER if admixtures, such as water reducers or superplasticizers, are utilized in the concrete mix. Regardless of the measured slump, the maximum allowable water-cement ratios as specified here-in, shall be strictly adhered to.

C. Compressive Strength, Water and Cement Content

Not withstanding what has been stated here-before, and unless shown otherwise on the Drawings, the concrete shall meet the following requirements. All concrete except as noted otherwise on the drawings shall have 4,500 psi 28-day compressive strength. The maximum water content per 94 pound sack of cement is 4.5 gallons. The minimum

cement content for the 4,000psi mix is 6.0 sacks (94 pound sack of cement per cubic yard of concrete). Up to a maximum of 15% of cementatious material may be fly ash in accordance with ASTM C618. The use ground granulated blast furnace slag is not allowed.

D. Retarding Densifiers

1. All concrete (as defined in 2.9 below) used for wall construction shall also contain DARATARD-17, as manufactured by Grace Const. Products, Cambridge, MA or MBL-82, as manufactured by Master Builders, Cleveland, OH in the amounts recommended by the additive manufacturer whenever the air temperature during the pour exceeds 85° F.

2. To be considered as equal, any alternate product offered for consideration shall contain no calcium chloride, and shall be compatible with air-entrained cements and air-entraining admixtures conforming to the applicable ASTM, AASHTO, ANSI and Federal specifications.

3. CONTRACTOR shall certify that admixtures do not contain calcium chlorides or other corrosive materials.

E. Air-Entraining Agents

1. All concrete that that is specified to be air entrained or that may be exposed to freeze/thaw action either during construction or the service life of the structure must be air entrained. Sufficient air-entraining agent shall be used to provide total air content of 5 percent, +/- 1 percent.

2. Air-entraining agents shall meet ASTM C 260, ASTM C 233 and ASTM C 457.

3. The maximum total volumetric air content of the concrete before placement shall be six (6) percent plus or minus one percent as determined by ASTM C 173 or ASTM 231.

4. Subject to these Specifications, consideration will be given to the following products: PROTEX “AES,” GRACE “DAREX AEA,” MASTER BUILDERS “MB-AE10,” or SIKA CHEMICAL “AER.”

F. Water Reducing Admixtures

1. In addition to air-entrainment, approved water reducing additives, which do not affect the ultimate performance of any steel in any way, may be added to maintain the maximum water content below that specified herein. Water reducing additives shall conform to ASTM C 494, Type A or D.

2. The use of water reducing additives shall not permit a reduction in the minimum specified cement content or in the specified amount of air-entrainment.

3. Admixtures shall contain no calcium chloride, tri-ethanolamine or fly ash. All admixtures shall be from the same manufacturer.

4. Superplasticizers, if allowed by the ENGINEER, shall conform to ASTM C 494, Type F or G, batch plant added using second or third generation only.

5. Set control admixtures if allowed by the ENGINEER, shall conform to ASTM C 494, Type B (retarding) or Type C (accelerating).

G. Fiber reinforcement admixture shall be included in the ready-mix concrete design used for filling and channeling the wet well chambers. Fibers shall be used in strict accordance with the manufacturer's directions.

2.9 CONCRETE MIXING

Ready-Mix Concrete - Comply with the requirements of ASTM C94, and as herein specified. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required. When the air temperature is between 85°F and 90°F, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90°F, reduce the mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 FORMS

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formworks so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design formworks to be readily removable without impact shock, or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Erect falsework and support; brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures.

Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.

F. Forms for Exposed Concrete

Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes. Do not use metal cover plates for patching holes or defects in forms. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material, which will produce bow. Assemble forms so they may be readily removed without damage to exposed concrete surfaces. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

Corner Treatment - Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines, except as otherwise indicated.

G. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings of forms at inconspicuous locations.

H. Chamfer exposed corners and edges, reveals and drips as shown using wood, metal, PVC or rubber strips fabricated to produce uniform smooth lines and tight edge joints.

I. Provisions for Other Trades - Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases

from trades providing such ties. Accurately place and securely support items built into forms.

J. Cleaning and Tightening - Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement if required to eliminate mortar leaks.

3.2 PLACING REINFORCEMENT

Detail and place according to ACI Manual SP-66. Unless otherwise noted, minimum cover shall be 1-1/2 inches for No. 5 and smaller bars, two (2) inches for No. 6 and larger bars and three (3) inches when poured against earth. Unless otherwise noted, bend all horizontals reinforcing a minimum of two (2) feet at corners and wall intersections.

A. Clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

B. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

C. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Do not place reinforcing bars more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

D. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus two (2) inches, and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.3 JOINTS

A. Construction Joints - Locate and install construction joints, which are not shown on the drawings, so as not to impair the strength and appearance of the structure, as acceptable to the ENGINEER.

B. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints. Unless otherwise specified, reinforcement shall be lapped in accordance with ACI Standards.

C. Waterstops - Provide waterstops in construction joints as shown on the drawings. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work. Fabricate field joints

in waterstops in accordance with manufacturer's printed instructions. Protect waterstop material from damage where it protrudes from any joint.

D. Isolation Joints in Slabs-on-Ground - Construct isolation joints in slabs-on-ground at all points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

E. Control Joints in Slabs-on-Ground - Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4-inch wide by one-fifth (1/5) to one-fourth (1/4) of the slab depth, unless otherwise shown.

1. Form control joints by inserting a premolded hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface. After the concrete has cured, remove inserts and clean groove of loose debris.

2. Joint sealant material shall be as specified above.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General - Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs - Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screed strips by the use of strike-off templates or accepted compacting type screeds.

C. Cast in Place Reglets - Place in straight and continuous lines as detailed to enable flashing to be applied continuously without deviation at reglet joints more than 1/8-inch. Miter corners for continuous reglet joint where outside corners occur. At inside corners extend one section 1-inch past corner. Adequately anchor or secure reglets per manufacturer's instructions prior to pouring and during construction to insure dimensional tolerances and alignment. Vibrate concrete to insure concrete cover adjacent to and around reglet. Visually inspect after pour and patch as required.

3.5 PREPARATION OF FORM SURFACES

Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed. Thin formcoating compounds only with thinning agent of type, and in amount, and under conditions of the form-coating compound manufacturer's directions. Use dissipating-type form oil at surfaces to receive cement plaster finish. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE PLACEMENT

A. Pre-Placement Inspection

1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work as required. Notify ENGINEER in time for inspection prior to pouring.

2. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.

3. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

4. Concrete Curbs and Paving - Do not place concrete until subbase is completed and approved by the ENGINEER as required to provide uniform dampened condition at the time concrete is placed. Moisten subbase as required to provide uniform dampened condition at the time concrete is placed.

B. Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete, which is being integrated, with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure, which will cause segregation.

2. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

3. Do not use concrete which becomes non-plastic and unworkable or does not meet the required quality control limits or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of in an acceptable location. Do not use concrete whose allowable mixing time has been exceeded.

C. Concrete Conveying

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods, which will prevent segregation and loss of concrete mix materials.

2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.

3. The CONTRACTOR shall provide traffic control on the narrow access roads to the work sites.

4. The CONTRACTOR shall not wash concrete trucks/chutes/equipment off at the project site unless plastic tarps and hay bales are employed to contain the concrete. The CONTRACTOR will be required to haul off-site all concrete contaminated soil.

D. Placing Concrete into Forms

1. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

2. Do not interrupt successive placement; do not permit cold joints to occur.

3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.

4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and project conditions. Vibration of forms and reinforcing will not be permitted.

5. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete at least six (6) inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

6. Do not place concrete in supporting elements until the concrete previously placed in columns and walls is no longer plastic.

E. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations using mechanical vibrating equipment so the concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Consolidate concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground, as specified for formed concrete structures. Consolidate concrete in the remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other acceptable methods. Limit the time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.

4. Bring slab surfaces to the correct level with a straight edge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

5. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

F. Bonding

1. Roughen surfaces of set concrete at all joints except where bonding is obtained by use of concrete bonding agent, and clean surfaces of laitance, coatings, loose particles and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and not to leave laitance, loose particles of aggregate or damaged concrete at the surface.

2. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:

   a. At joints between footings and walls or columns, and between walls or columns and beams or slabs they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

   b. At joints in exposed work; at vertical joints in walls; at joints in girders, beams, supported slabs and other structural members; and at joints designed to contain liquids; dampen, but do not saturate the roughened and cleaned surface of set concrete and apply a liberal coating of neat cement grout.

c. Use neat cement grout consisting of equal parts Portland cement and fine aggregate by weight and not more than six (6) gallons of water per sack of cement. Apply with a stiff broom or brush to a minimum thickness of 1/16-inch. Deposit fresh concrete before cement grout has attained its initial set.

d. In lieu of neat cement grout, bonding grout may be a commercial bonding agent. Apply to cleaned concrete surfaces in accordance with the printed instructions of the bonding material manufacturer.

3. Prepare for bonding of fresh concrete to fully cured hardened concrete or existing concrete by using an epoxy-resin-bonding agent as follows:

a. Handle and store epoxy-resin adhesive binder in compliance with the manufacturer's printed instructions, including safety precautions.

b. Mix the epoxy-resin adhesive binder in the proportions recommended by the manufacturer, carefully following directions for safety of personnel.

c. Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy-resin grout not less than 1/16-inch thick. Place fresh concrete while the epoxy-resin material is still tacky, without removing the in-place grout coat, and as directed by the epoxy-resin manufacturer.

G. Cold Weather Placing

1. Protect all concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.

2. When the air temperature has fallen to or is expected to fall below 40°F, provide adequate means to maintain the temperature in the area where concrete is being placed at either 70°F for three (3) days or 50°F for five (5) days after placing. Provide temporary housing or coverings including tarpaulins or plastic film. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. Keep concrete moist. Avoid rapid dry-out of concrete due to over-heating and avoid thermal shock due to sudden cooling or heating.

3. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50°F, and not more than 80°F, at point of placement.

4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms,

reinforcing steel and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.

5. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

3. Cover reinforcing steel with water soaked burlap if it becomes too hot so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

4. Wet forms thoroughly before placing concrete.

5. Do not use retarding admixtures unless otherwise accepted in mix designs.

3.7 FINISH OF FORMED SURFACES

A. Rough Form Finish

For formed concrete surfaces not exposed to view in the finish work or covered by other construction, unless otherwise shown or specified. This is the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4-inch in height rubbed down or chipped off.

B. Smooth Form Finish

Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view. Or that are to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete such as waterproofing, damp proofing, painting or other similar system.

Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed.

C. Curb Finishes

Curbs shall be screeded off accurately to true lines and planes or warped surfaces as indicated or directed. Finish smooth. Arises shall be true and straight or properly eased where curved and neatly rounded with approved tool. Smooth trowel finish with corners rounded to 3/4-inch radius.

D. Grout Cleaned Finish (Sacked)

Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment, and to all exposed to view interior and exterior building surfaces, typical.

Combine one part Portland cement to 1-1/2 parts fine sand by volume, and mix with water to the consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces

At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.8 MONOLITHIC SLAB FINISHES

A. Float Finish

1. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing or sand bed terrazzo, and as otherwise shown on drawings or in schedules.

2. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float, or both. Consolidate the surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding 1/4-inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill at low

spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

B. Trowel Finish

1. Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and slab surfaces that are to be covered with resilient flooring, paint, or other thin-film finish coating system.

2. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

3. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with a 10-foot straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

C. Exposed Aggregate Finish

1. Screed to true plane, bullfloat surfaces, provide uniform double troweled finish. After troweling, let set until hard enough to wash without disturbing coarse aggregates. Simultaneously brush and spray with water to expose large aggregate and produce texture to match approved sample. Water cure or keep wet for 25 hours.

2. Scrub surface after 24 hours with a one (1) part muriatic acid to10 part water solution. Rinse thoroughly.

D. Broom Finish (Non-Slip)

1. Apply non-slip, broom finish to exterior concrete platforms, steps and ramps and elsewhere as shown on the drawings or in schedules.

2. Immediately after trowel finish, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route or in the direction of water flow. Use fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the ENGINEER before application.

E. Chemical-Hardener Finish

1. Apply chemical curing-hardening compound or chemical-hardener to all interior concrete floors which will not receive applied finish materials. Mask adjacent work and surfaces to avoid over spray. Apply liquid chemical-hardener after complete curing and drying of the concrete surface.

2. Dilute the liquid hardener with water and apply in accordance with the manufacturer's printed directions. Evenly apply each coat and allow for drying between coats in accordance with manufacturer's printed directions.

3. After the final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

F. Non-slip Aggregate Finish

Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, and elsewhere as shown on the drawings or in schedules.

After completion of float finishing and before starting trowel finish, uniformly spread 25 pounds of dampened non-slip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using steel trowel, but do not force the non-slip aggregate particles below surface. After broadcasting and tamping, apply trowel finish as herein specified. After curing, lightly work the surface with a steel wire brush, or an abrasive stone, and water to expose the non-slip aggregate.

3.9 SCHEDULE OF CONCRETE SURFACE FINISHES

Also see Section 09 90 00, Painting and Coating for protective coating requirements.

Surface Description		Type	Finish Requirement
A.	Interior Horizontal Slabs	Slab	Trowel Finish
B.	Exterior Horizontal Slabs	Slab	Broom Finish (Non-Slip)
C.	Stair Treads, Platforms and Ramps	Slab	Non-Slip Aggregate
D.	Interior Vertical Surfaces (including Wet Well)	Formed	Smooth Form
E.	Exterior Vertical Surfaces Exposed to View	Formed	Smooth Form

3.10 CONCRETE CURING AND PROTECTION

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least seven (7) days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Curing Methods

Perform curing of concrete by moist curing, by moisture-retaining cover curing, by membrane curing or by combinations thereof, as herein specified. Provide the curing methods indicated as follows:

1. For concrete floor slabs provide moisture curing, moisture cover curing or liquid membrane/chemical curing-hardening curing. If liquid membrane curing is used, it must be compatible with concrete hardening compounds to be applied later.

2. For other concrete work, provide moisture curing or moisture cover curing. Do not use liquid membrane or chemical curing-hardening curing on any concrete work to receive any applied finishes.

3. For curing, use only water that is free of impurities, which could etch or discolor exposed, natural concrete surfaces.

4. Provide moisture curing by any of the following methods:

    a. Keeping the surface of the concrete continuously wet by covering with water.

    b. Continuous water-fog spray.

    c. Covering the concrete surface with the specified absorptive cover thoroughly saturated with water and keeping the absorptive cover continuously wet. Place absorptive cover so as to provide coverage of the concrete surfaces and edges with a 4-inch lap over adjacent absorptive covers.

5. Provide moisture-cover curing as follows - Cover the concrete surfaces with the specified moisture-retaining cover for curing concrete placed in the widest practicable width with sides and ends lapped at least three (3) inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.

6. Provide liquid membrane curing as follows:

    a. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply uniformly in a coat continuous operation by power spray equipment in accordance with the manufacturer's directions. Recoat areas, which are subjected to heavy rainfall within three (3) hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.

    b. Do not use membrane-curing compounds on surfaces, which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete. Such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the ENGINEER.

7. Curing formed Surfaces - Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

8. Curing Unformed Surfaces

    a. Initially cure unformed surfaces, such as slabs, floor topping and other flat surfaces by moist curing, whenever possible.

    b. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

    c. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise acceptable to the ENGINEER.

9. Provide liquid curing-hardening compound as follows:

    a. Apply to horizontal surfaces when concrete is dry to touch by means of power spray, hand spray or hair broom in accordance with manufacturer's directions.

C. Temperature of Concrete during Curing

1. When the atmospheric temperature is 40°F and below, maintain the concrete temperature between 50°F and 70°F continuously throughout the curing period. When necessary, make arrangements before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously for the concrete curing period. Provide cold weather protections complying with the requirements of ACI 306.

2. When the atmospheric temperature is 80°F, and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation wind breaks or shading, and for fog spraying, wet sprinkling or moisture-retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protections complying with the requirements of ACI 305.

3. Maintain concrete temperature as uniformly as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete, which exceed 5°F in any one-hour and 50°F in any 24-hour period.

D. Protection from Mechanical Injury - During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In - Fill-in holes and openings in concrete structures for the passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

B. Curbs - Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations - Provide machine and equipment bases and foundations as shown on the drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment.

3.12 REMOVAL OF SHORES AND FORMS

A. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support the work without excessive stress or deflection.

Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until the concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns and similar parts of the work, may be removed after cumulative curing at not less than

50°F for 24 hours after placing concrete. Providing the concrete is sufficiently hard to not be damaged by form removal operations and provided curing and protection operations are maintained.

C. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in place concrete by testing field-cured specimens representative of concrete location or members.

D. Form facing material may be removed four (4) days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

E. Re-Use of Forms

Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use “patched” forms for exposed concrete surfaces, except as acceptable to the Architect.

No forming material will be allowed to be built permanently into exposed visible surfaces.

3.13 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas

1. Repair and patch defective areas with cement mortar immediately after removal of forms but only when directed by the ENGINEER.

2. Cut out honeycomb, rock pockets, voids over 1/2-inch diameter and holes left by tie rods and bolts down to solid concrete but, in no case, to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the ENGINEER.

3. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify

mixture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

4. Fill holes extending through concrete by means of a plunger type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

B. Repair of Formed Surfaces

1. Repair exposed-to-view formed concrete surfaces that contain defects, which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the ENGINEER. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolt; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.

2. Repair concealed formed concrete surfaces that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects, as such, include cracks in excess of 0.01-inch wide, cracks or any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corners.

C. Repair of Unformed Surfaces

1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.

2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finished unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so those repairs can be made without damage to adjacent areas.

5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh

concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the ENGINEER.

6. Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with a neat cement grout coating, or use concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same material to provide concrete of the same type or class as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

7. Repair isolated random cracks and single holes not over 1 inch in diameter by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean off dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with a neat cement grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

8. For repair of existing unformed surfaces, mechanically remove all lose concrete as required to expose sound aggregate. Clean concrete surfaces to achieve a contaminate free, open textured surface. Square cut or under cut perimeter to minimum depth as specified by the repair mortar manufacturer. Remove all lose concrete around the exposed steel and hand tool or blast clean all portions of rebar with visible rust to near white metal finish. If half of the diameter of the reinforcing steel is exposed, chip out behind the reinforcing to a 1/2-inch minimum depth. Splice new reinforcing steel to existing where corrosion has depleted the cross-section area by 25%. Apply a corrosion inhibitor/primer/bonding agent to all exposed rebar and other steel components and to concrete surfaces to be repaired per manufacturer’s requirements, such as Sika Armatec 110 . Apply a polymer-modified, cement-based, repair mortar, trowel applied as specified by the manufacturer, such as Sika MonoTop 615.

9. Repair methods not specified above may be used subject to the acceptance of the ENGINEER.

3.14 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The OWNER or a representative of the OWNER will engage a special inspector/testing laboratory to perform all tests and to submit test reports to the ENGINEER and the CONTRACTOR.

B. Concrete shall be sampled and tested for quality control during the placement of concrete, as follows:

1. Sampling Fresh Concrete - ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump - ASTM 143; one (1) test for each concrete load at point of discharge; and one (1) for each set of compressive strength test specimens.

3. Air Content - ASTM C231, pressure method; one (1) for each set of compressive strength test specimens.

4. Compression Test Specimen - ASTM C31; one (1) set of four (4) standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

5. Concrete Temperature - Test hourly when air temperature is 40°F and below, and when 80°F and above; and each time a set of compression test specimens is made.

6. Compressive Strength Tests - ASTM C39; one (1) set for each 100 cubic yards or fraction thereof, of each concrete class placed in any one (1) day or for each 5,000 square feet of surface area placed; one (1) specimen tested at seven (7) days, two (2) specimens tested at 28 days, and one (1) specimen retained in reserve for later testing if required.

   a. When the frequency of testing will provide less than five (5) strength tests for a given class of concrete, conduct testing from at least five (5) randomly selected batches or from each batch if fewer than five (5) are used.

   b. When the total quantity of a given class of concrete is less than 50 cubic yards, the strength tests may be waived by the ENGINEER if, in his judgment, adequate evidence of satisfactory strength is provided.

   c. If required by the building official, perform strength tests of cylinders cured under field conditions. Field cured cylinders shall be taken and molded at the same time and from the same samples as the laboratory cured test cylinders. When the strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

C. Report test results in writing to the ENGINEER and the CONTRACTOR on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of CONTRACTOR, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength and type of break for both 7-day tests and 28-day tests.

D. Additional tests - The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the ENGINEER. The testing service shall conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. CONTRACTOR shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 03 60 00

GROUTING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all work necessary to form, mix, place, cure, repair, finish, and do all other work as required to produce finished grout, in accordance with the requirements of the Contract Documents.

B. Work covered in this Section includes:

1. Grouting.
2. Removal of loose and spalling grout and concrete.
3. Anchoring, patching, grouting, and sealing.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-In-Place Concrete.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Specifications, codes, and standards shall be as specified in Section 03 30 00, Cast-In-Place Concrete and as referred to herein.

B. Commercial Standards:

1. CRD-C 621, Corps of Engineers Specification for Non-Shrink Grout

2. ASTM C109, “Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens)”

3. ASTM C531, “Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”

4. ASTM C579, “Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”

5. ASTM C827, “Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures”

1.4 SUBMITTALS

A. Certified Test Results: Verifying the compressive strength, shrinkage, and expansion requirements specified herein.

B. Manufacturer's Literature: Containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of non-shrink and epoxy grout used in the work.

1.5 QUALITY ASSURANCE

Field Tests

A. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the ENGINEER to insure continued compliance with these specifications. The specimens will be made by the ENGINEER or its representative.

B. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the ENGINEER. A set of three specimens will be made for testing at seven (7) days, 28 days, and each additional time period as appropriate.

C. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the CONTRACTOR.

D. The cost of all laboratory tests on grout shall be borne by the CONTRACTOR and the CONTRACTOR shall obtain the specimens for testing. The CONTRACTOR shall also be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The CONTRACTOR shall supply all materials necessary for fabricating the test specimens.

PART 2 PRODUCTS

2.1 PREPACKAGED GROUTS

A. Non-shrink grout: This type of grout is to be used wherever grout is required in the Contract Documents, unless another type is specifically referenced.

B. Non-shrink grout shall be a prepackaged, inorganic, non-gas- liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation of each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.

C. Class A non-shrink grouts shall have minimum 28 day compressive strength of 5000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRDC 621.

D. Class B non-shrink grouts shall have minimum 28 day compressive strength of 5000 psi and shall meet the requirements of CRD C621.

E. Application

1. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout specified herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

2. Class B non-shrink grout shall be used or the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

2.2 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where “dry pack” is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed four (4) inches.

2.3 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers approved by the ENGINEER. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified by the manufacturer. The finish of the grout surface shall match that of the adjacent concrete.

B. The manufacturer of Class A non-shrink grout shall provide on-site technical assistance upon request.

C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the ENGINEER.

3.2 GROUTING PROCEDURES

Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution of prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. The extent of metal fabrications work is shown on the Drawings and includes items fabricated from iron, steel, stainless steel and aluminum shapes, plates, bars, sheets, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems in other sections of these specifications.

B. Section Includes:

1. Shop-fabricated metal items.
2. Bollards.
3. Ladders.
4. Anchor bolts.
5. Handrails, ladders and railings.
6. Gratings.
7. Roof access hatches.
8. Fasteners.
9. Roof vents.
10. Reservoir interior piping and appurtenances
11. Miscellaneous fabricated architectural details.
12. Miscellaneous framing, fabrication and supports

1.2 RELATED SECTIONS

A. Section 03 11 00, Concrete Work.
B. Section 09 90 00, Painting and Coating.
C. Section 33 16 13.13, Steel Aboveground Water Utility Storage Tanks.

1.3 REFERENCE STANDARDS

A. Aluminum Association:

1. AA DAF-45 - Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association:

1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

3. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

C. American National Standards Institute:

1. ANSI A14.3 - American National Standard (ASC) for Ladders - Fixed - Safety Requirements.

D. American Welding Society:

1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

2. AWS D1.1 - Structural Welding Code - Steel.

3. AWS D1.6 - Structural Welding Code - Stainless Steel.

E. ASTM International:

1. ASTM A6 - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

2. ASTM A36 - Standard Specification for Carbon Structural Steel.

3. ASTM A47, grade as selected - Malleable Iron Castings.

4. ASTM A48, Class 30 - Gray Iron Castings.

5. ASTM A53- Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

6. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

7. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

8. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

9. ASTM A193 - Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High-Pressure Service and Other Special Purpose Applications.

10. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
11. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless-Steel Tubing for General Service.
12. ASTM A283, Grade C - Steel Plates to be Bent or Cold Formed.
13. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
14. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
15. ASTM A312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless-Steel Pipes.
16. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
17. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
18. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
19. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
20. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.
21. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
22. ASTM A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
23. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
24. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
25. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
26. ASTM A992 - Standard Specification for Structural Steel Shapes.
27. ASTM B26 - Standard Specification for Aluminum-Alloy Sand Castings.
28. ASTM B85 - Standard Specification for Aluminum-Alloy Die Castings.

29. ASTM B177 - Standard Guide for Engineering Chromium Electroplating.
30. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
31. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
32. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.
33. ASTM B 308, Alloy 6061-T6, Anodic Coating Class I, AA-C22-A41, anodized after fabrication - Structural Aluminum Shapes and Plates.
34. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
35. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
36. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
37. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.
38. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength.
39. ASTM F436 - Standard Specification for Hardened Steel Washers.
40. ASTM F844 - Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
41. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength.

F. Builders Hardware Manufacturers Association (BHMA):

1. ANSI/BHMA A156.20 - American National Standard for Strap and Tee Hinges and Hasps.

G. National Ornamental & Miscellaneous Metals Association:

1. NOMMA Guideline 1 - Joint Finishes.

H. SSPC: The Society for Protective Coatings:

1. SSPC - Steel Structures Painting Manual.

2. SSPC Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
3. SSPC Paint 20 - Zinc-Rich Coating (Type I - Inorganic and Type II - Organic).
4. SSPC SP 1 - Solvent Cleaning.
5. SSPC SP-7 Brush-off Blast Cleaning.
6. SSPC SP 10 - Near-White Blast Cleaning.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Data: For information only, submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions for products to be used in miscellaneous metal work, including paint products.

C. Shop Drawings:

1. General: Submit copies of shop drawings for the fabrication and erection of all assemblies of miscellaneous metal work which are not completely shown by the manufacturer's data sheets.

   a. Include plans, elevations and details of sections and connections and fabricators proposed shop coat paint or galvanizing specifications.

   b. Show anchorage and accessory items.

   c. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete construction.

   d. Indicate welded connections using standard AWS A2.4 welding symbols.

   e. Indicate net weld lengths.

2. Stairs, Handrails and Railings:

   a. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

3. Gratings:

   a. Indicate details of gratings, plates, component supports, anchorages, openings, perimeter construction details, and tolerances.

D. Samples:

1. Submit two sets of representative samples of materials, illustrating factory finishes as may be requested by the Engineer.

2. Engineer's review will be for color, texture, style and finish only.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Transporting, handling, storing, and protecting products shall be in accordance with manufacturer's requirements.

B. Inspection: Accept metal fabrications on-site in labeled shipments. Inspect for damage.

C. Protect metal fabrications from damage by exposure to weather or by ground contact.

1.6 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to preparation of Shop Drawings and fabrication. Indicate field measurements on Shop Drawings.

1. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication.

PART 2 PRODUCTS

2.1 GENERAL

A. For the fabrication of miscellaneous metal work items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, roughness and defects which impair strength, durability and appearance. Remove such blemishes by grinding or by welding and grinding prior to cleaning, treating and application of surface finishes including zinc coatings.

2.2 BOLLARDS

A. Description:

1. Steel pipe, concrete filled.
2. Crowned cap.
3. Size: 6-inch diameter, length as indicated on Drawings.
4. Shop Finish: Prime-paint, one coat.

B. Concrete Fill:

1. Minimum Compressive Strength: 3,000 psi.
2. As specified in Section 03 11 00, Concrete Work.

C. Anchors: Concealed type as indicated on Drawings.

2.3 LADDERS

A. Interior Reservoir Steel Ladder:

1. ANSI A14.3.

2. Steel – welded construction.

3. Siderails:

a. Size: 1/2 by 2 inches.
b. Spacing: 16 inches o.c.

4. Rungs:

a. Solid rod. Hex rod or gnarled rebar.
b. Size: 1-inch diameter.
c. Spacing: 12 inches o.c.

5. Mounting:

a. Space rungs as shown on Drawings, minimum of 7 inches from wall surface.
b. Provide steel mounting brackets and attachments per Drawings.

6. Shop Finish: Prime paint, one coat is permissible.

B. Exterior Reservoir Steel Ladder:

1. ANSI A14.3.

2. Steel – welded construction.

3. Siderails:

a. Size: 1/2 by 2 inches.
b. Spacing: 16 inches o.c.

4. Rungs:

a. Solid rod. Hex rod or gnarled rebar.

b. Size: 1-inch diameter.
c. Spacing: 12 inches o.c.

5. Mounting:

a. Space rungs as shown on Drawings, minimum of 7 inches from wall surface.
b. Provide steel mounting brackets and attachments per Drawings.

6. Shop Finish: Mill finish

C. Ladder Security Enclosure:

1. Description: Formed to enclose ladder siderails and rungs when closed and to swing free of ladder rungs and siderails with minimum 1-1/2-inch clear to siderails in open position.

2. Sheet steel.

3. Thickness: Minimum 16 gage/0.058 inch formed to enclose ladder siderails and rungs when closed and to swing free of ladder rungs and siderails with minimum 1-1/2-inch clear to siderails in open position.

4. Provide continuous steel hinge full height of enclosure.

5. Provide steel hasp for padlocking in closed and open position.

6. Finish: Match ladder finish.

2.4 ANCHORS

A. All anchors shall be epoxy anchors or expansion anchors as shown in the Drawings.

B. Materials:

1. As shown in the Drawings.

2. For direct bury:

a. Malleable iron complying with ASTM A47.
b. Cast steel complying with ASTM A27.
c. Iron and steel galvanized in compliance with ASTM A153.

3. For wetted atmospheric conditions

a. Type 316 stainless steel.

4. Threaded rod, nuts, bolts and washers:

    a. Material matching anchor insert type.

C. Types:

1. Threaded-type Concrete Inserts:

    a. Internally threaded to receive machine bolts.
    b. Malleable iron, ASTM A47.
    c. Cast steel, ASTM A27.
    d. Stainless steel, type 304, ASTM A320.

2. Wedge-type Concrete Inserts:

    a. Box-type ferrous castings, designed to accept bolts having special wedge-shaped heads.

3. Slotted-type Concrete Inserts:

    a. Box-type welded construction with slot designed to receive square head bolt and with knockout cover.

D. Manufacturers:

1. Hilti, Inc.
2. Simpson Strong-Tie Co., Inc.
3. Proprietary products as named in the Drawings.

2.5 HANDRAILS AND RAILINGS

A. Maximum spacing between members shall be as directed by local code and OSHA requirements unless otherwise noted on the Drawings.

B. Railing assembly, wall rails, and attachments to resist lateral force of 200 lb. at any point without damage or permanent set. Test according to ASTM E935.

C. Construction:

1. Height: 3 foot 6-inch high.

2. Outside diameter:

    a. 2-inch for top and vertical segments.
    b. 1 1/2-inch all others.

3. Top corners of handrail are to be bent to the smallest radius possible without causing grain separation or otherwise impairing the work.

4. Radius Sections -- Roll to radii shown on Drawings.

5. Vertical segments of handrail are to be set plumb and mount as shown on Drawings or as otherwise specified.

6. Spacing between vertical segments will be according to Drawings.

D. Welded Connections:

1. Cope intersections of rails and posts, weld joints of tailings or use welding connectors, at fabricator's option.

   a. Other methods of welding may be used when acceptable to the Engineer.

2. Weld corners and seams continuously and in accordance with the recommendations of AWS.

3. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.

4. Discoloration of finished surfaces and sharp edges will not be acceptable.

E. Materials: As shown on the Drawings.

2.6 ACCESS HATCHES

A. Use materials of the size and thickness shown in Drawings or, if not shown in the Drawings, of the size recommended by product manufacturer.

B. Work to the dimension shown in the Drawings or accepted on final shop drawings, using proven details of fabrication and support.

C. Use the type of materials shown or specified for the various components of the Work.

D. Reservoir Roof Access Hatch:

1. Frame opening length x width = 3'-0" x 4'-0"

2. External grip handle.

3. Heavy duty hinges and pins.

4. Heavy duty hold-open arm.

5. Watertight, “shoe box” style construction. Provide full overlap of hatch curb by a minimum 4 inches.

6. Stainless steel slam-lock with brass spoon handle.

7. All steel plate, sheeting and hardware to be galvanized or cadmium plated except as noted above.

8. Shop finish of aluminum cover: Mill finish.

9. Recessed hasp for pad lock.

2.7 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting systems. Acceptable manufacturers are Simpson, or approved equal.

B. Manufacture or fabricate items of sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere furnish galvanized steel washers.

2.8 MISCELLANEOUS FABRICATIONS, FRAMING AND SUPPORTS

A. Provide miscellaneous steel framing and supports required to complete the Work.

B. Fabricate miscellaneous units to the sizes, shapes and profiles shown in the Drawings or, if not shown, of the required dimensions to receive adjacent grating, plates doors, or other work to be retained by the framing.

C. Except as otherwise shown, fabricate from structural steel shapes and plate and steel bars, all welded construction using mitered corners, welded brackets and splice plates and a minimum number of joints for field connection.

D. Cut, drill and tap units to receive hardware and similar items to be anchored to the work.

E. Equip units with integrally welded anchors for casting into concrete, bolting to structural steel or building into masonry. Furnish inserts if units must be installed after concrete is placed.

F. Galvanize all miscellaneous fabrications unless otherwise noted.

2.9 NON-SHRINK GROUT

A. Where required for anchoring, patching, or sealing, grouting and sealing compounds shall conform to the requirements of Section 03 60 00, Grouting.

2.10 MATERIALS

A. Materials listed below shall be provided unless otherwise noted in the Drawings or other sections of these specification.

B. Steel:

1. Structural W Shapes: ASTM A992.
2. Structural Shapes: ASTM A36.
3. Channels and Angles: ASTM A36.
4. Steel Plate: ASTM A36.
    a. Steel Plate to be Bent or Cold Formed: ASTM A283, Grade C.
5. Hollow Structural Sections: ASTM A500, Grade B.
6. Structural Pipe: ASTM A53, Grade B, Schedule 40 unless shown otherwise in Drawings.
7. Bar: ASTM A36 .
    a. Cold-Finished Steel Bar: ASTM A108, grade as selected by fabricator.
8. Sheet Steel: ASTM A653, Grade 33 Structural Quality.
9. Tubing: ASTM A513, Type 5, minimum 50 ksi yield strength.
10. Standard Bolts: ASTM A307; Grade A.
    a. Washers: ASTM F844.
11. High Strength Bolts: ASTM A325.
    a. Washers: ASTM F436; Type 1.
12. Nuts: ASTM A563; heavy-hex type.
13. Welding Materials: AWS D1.1; type required for materials being welded.

C. Stainless Steel:

1. Bars and Shapes: ASTM A276; Type 316.
2. Tubing: ASTM A269; Type 316.
3. Pipe: ASTM A312, seamless; Type 316.
4. Plate, Sheet, and Strip: ASTM A666; Type 316.

5. Bolts, Nuts, and Washers: ASTM A354; Type 316.
6. Welding Materials: AWS D1.6; type required for materials being welded.

D. Aluminum:

1. Structural Aluminum Shapes and Plates: ASTM B308, Alloy 6061, Temper T66, Anodic Coating Class I, anodized after fabrication.

2. Aluminum-Alloy-Drawn Seamless Tubes: ASTM B210 Alloy 6063, Temper T6.

3. Aluminum-Alloy Bars: ASTM B211 Alloy 6063, Temper T6.

4. Bolts, Nuts, and Washers: Stainless steel or Steel, galvanized.

5. Welding Materials: AWS D1.1; type required for materials being welded.

E. Bolts, Nuts, and Washers for Equipment and Piping:

1. Select fasteners for the type, grade and class required for the installation of miscellaneous metal items.

2. Carbon Steel:

a. General: Zinc-coated, ASTM A153.
b. Structural Connections: ASTM A307, Grade 2 (60 ksi), hot-dip galvanized.
c. Anchor Bolts: ASTM A307, Grade 2 (60 ksi), hot-dip galvanized.
d. Pipe and Equipment Flange Bolts: ASTM A193, Grade B-7.
e. High Strength Bolts: ASTM F3125, Heavy Hex Head.

3. Stainless Steel: Type 316 stainless steel, Class 2; ASTM A193 for bolts; ASTM A194 for nuts.

a. Where stainless steel bolts are in contact with dissimilar metals, glass epoxy insulating sleeves and washers shall be used to electrically isolate the bolts.

2.11 FABRICATION

A. Workmanship:

1. Use materials of the size and thicknesses shown in the Drawings or, if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use as approved by the Engineer.

2. Work to the dimensions shown in the Drawings or accepted on Shop Drawings, using proven details of fabrication and support.

3. Use the type of materials shown in the Drawings or specified for the various components of work.

4. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

5. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise shown in the Drawings.

6. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the Work.

B. Fit and shop-assemble items in largest practical sections for delivery to Site.

C. Fabricate items with joints tightly fitted and secured.

D. Continuously seal join members by means of continuous welds in accordance with the recommendations of AWS, unless otherwise noted or approved.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small, uniform radius.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

H. Loose Bearing and Leveling Plates:

1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area.

2. Drill plates to receive anchor bolts and for grouting as required.

3. Galvanize after fabrication.

I. Miscellaneous Steel Trim:

1. Provide shapes and sizes for profiles shown in the Drawings.

2. Except as otherwise indicated, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges.

3. Use concealed field splices wherever possible.

4. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other work.

J. Fabrication Tolerances:

1. Squareness: 1/8-inch maximum difference in diagonal measurements.
2. Maximum Offset between Faces: 1/16 inch.
3. Maximum Misalignment of Adjacent Members: 1/16 inch.
4. Maximum Bow: 1/8 inch in 48 inches.
5. Maximum Deviation from Plane: 1/16 inch in 48 inches.

2.12 FINISHES

A. Steel:

1. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

2. Do not prime surfaces in direct contact with concrete or where field welding is required.

3. Prime-paint items with one coat, except where galvanizing is specified.

4. Coatings as specified per Section 09 9000, Painting and Coating.

   a. Primer paint selected must be compatible with the required finish coats of paint.

   b. At locations in contact with potable water, use only primer approved for potable water use.

5. Galvanizing for Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123; hot-dip galvanize after fabrication.

6. Galvanizing for Fasteners, Connectors, and Anchors:

   a. Hot-Dip Galvanizing: ASTM A153.
   b. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

7. Chrome Plating: ASTM B177, nickel-chromium alloy, satinfinish.

8. Sheet Steel: Galvanized.

9. Bolts: Hot-dip galvanized.

10. Nuts: Hot-dip galvanized.

11. Washers: Hot-dip galvanized.

12. Touchup Primer for Galvanized Surfaces: ASTM A780 (A780M), A1. Repair Using Zinc-Based Alloys (Heat and Stick Method).

B. Stainless Steel:

1. Satin-Polished Finish: Number 4, satin directional polish parallel with long dimension of finished face.

2. Mirror-Polished Finish: Number 8, mirror polish with preliminary directional polish lines removed.

C. Aluminum:

1. Protection of All Aluminum:

a. Aluminum surfaces in contact with cementitious, masonry or dissimilar materials, apply the following coating system:

1) One (1) coat of epoxy primer, 1 to 2 mils dry film (D.F.).
2) Followed by two (2) coats of Bitumastic, 6 to 8 mils D.F.
3) Followed by two (2) coats of tarset material, 6 to 8 mils D.F.

D. Shop Painting

1. Shop painting of metal fabrications shall be allowed only at the sole discretion of the Engineer.

2. Shop paint miscellaneous metal work in accordance with Section 09 90 00, Painting and Coating, with the following exceptions:

a. Those members or portions of members to be embedded in concrete or masonry.

b. Surfaces and edges to be field welded.

c. Galvanized surfaces.

3. Remove scale, rust and other deleterious materials before the shop coat of paint is applied.

a. Clean off heavy rust and loose mill scale in accordance with SSPC SP-7, Brush-off Blast Cleaning.

b. Remove oil, grease and similar contaminates in accordance with SSPC SP-1, Solvent Cleaning.

4. Immediately following surface preparation, brush or spray on metal primer paint, applied in accordance with the manufacturer's instructions or as specified below.

5. Apply one (1) shop coat of metal primer paint to fabricated metal items, except apply two (2) coats of paint to surfaces which will be inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

E. Touch-up Painting, Pre-painted Items:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all exposed areas with the same material as used for shop painting.

2. Apply touch-up coatings by brush or spray to provide a minimum dry film thickness of the original coating thickness.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal and aluminum where Site welding is required.

B. Furnish setting drawings, diagrams, templates, instructions and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections. Coordinate delivery of such items to the project Site.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, and free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment until permanent bracing and attachments are installed.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal items to in-place construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

D. Fit exposed connections accurately together to form tight hairline joints.

E. Grind joints smooth and touch-up shop paint coat.

F. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

G. Field-weld components indicated on Drawings and Shop Drawings.

H. Perform field welding according to AWS D1.1 with regards to procedures of manual shielded metal-arc welding, the appearance and quality of welds made and the methods used in correcting welding work.

I. Obtain approval of Engineer prior to Site cutting or making adjustments not scheduled.

3.4 TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per story or for every 12 feet in height, whichever is greater, non-cumulative.

B. Maximum Variation from Level: 1/16 inch in 3 feet and 1/4 inch in 10 feet.

C. Maximum Offset from Alignment: 1/4 inch.

D. Maximum Out-of-Position: 1/4 inch.

3.5 FIELD QUALITY CONTROL

A. Welding: Inspect welds according to AWS D1.1.

B. Replace damaged or improperly functioning hardware.

C. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

D. Touch up factory-applied finishes according to manufacturer-recommended procedures.

3.6 ADJUSTING

A. Adjust operating hardware and lubricate as necessary for smooth operation.

END OF SECTION

SECTION 07 92 25

SEALANTS AND CAULKING FOR STEEL RESERVOIRS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the work necessary to furnish and install sealing or caulking joints between dissimilar materials for watertight seal. Work includes sealing the joint between the exterior floor of the tank and the top of the reinforced concrete foundation.

B. Section includes:

1. Sealants.
2. Filler gaskets.
3. Primers and bond breakers.

C. Related Requirements:

1. Section 33 16 13.13 - Steel Aboveground Water Utility Storage Tanks.

1.2 DEFINITIONS

A. Sealants: Where the words “sealants” or “caulking” are used in this text, they shall be synonymous and shall mean sealant or caulking compounds as specified under Part 2 of this specification.

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.
B. Product data and materials list of items proposed to be provided under this Section.
C. Sufficient technical data to demonstrate compliance with the specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Type A Sealant

1. Application: Joint between steel reservoir reinforced concrete ring wall foundation and exterior steel floor and wall connection.

2. Material: One component polyurethane sealant.

    a. Dymonic 100, as manufactured by Tremco Commercial Sealants & Waterproofing.

    b. Approved equal.

B. Filler Gasket (Backer Rod) Cord Strip

1. Sonolastic Closed-cell Backer Rod, as manufactured by Sonneborn.
2. Equal, as approved by ENGINEER.

PART 3 EXECUTION

3.1 PREPARATION

A. Surfaces to receive caulking materials shall be thoroughly clean and free of any non-compatible primers or protective coatings, including lacquers, form coatings, clear sealers, etc.

B. Brush out all foreign matter and loose particles.

C. Clean metal surfaces with solvents and wipe dry while the surface is still wet with solvent.

3.2 INSTALLATION

A. Primers and Bond Breakers

1. Apply to surfaces as required; verify with manufacturer.

2. In general, prime all concrete and Portland cement-based plaster or grout surfaces.

3. Use proper type primers and bond breakers, apply per sealant manufacturer's printed instructions.

B. Sealants

1. Provide watertight caulked joints at all building exterior locations where possible water penetration through joint may occur.

2. If caulking systems for such joints are not shown, provide as specifically approved.

C. Gaskets or Fillers

1. Compress all gaskets to tight fit. Where required as backing for caulking system, roll or stretch in gasket sections to depth from sealant face or as shown (in general, to 3/8-inch).

2. Install gun grade material with gun nozzle of similar size as joint width as shown. Tool all beads, after application to assume full firm contact. Strike off excess material.

3. Maintain edge surfaces adjacent to joints clean and free of caulking stain and excess material. Trim joints as required per manufacturer's printed instructions.

4. Do not apply caulking materials to a "bleeding" type of surface, such as asphaltic or other oil-emitting types. Where such material occurs at caulking joint (roofing, etc.), isolate from caulking with gasket filler.

5. Avoid mixing any water in caulking mixture before and during application. Do not thin material.

3.3 CORRECTIONS AND CLEANUP

A. Remove all damaged, defective or improperly installed sealant and/or caulking and replace.

B. Clean and remove all sealant and caulking from adjacent surfaces.

C. Upon completion of the work, remove all disused implements, rubbish, and debris, and leave premises neat and clean.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATINGS

PART 1 GENERAL

1.1 THE REQUIREMENT

A. Work under this Section shall include the protective coating of all specified surfaces including all surface preparation, pretreatment, coating application, touch-up of factory coated surfaces, protection of surfaces not to be coated, cleanup, and appurtenant work, all in accordance with the requirements of the Contract Documents.

B. This specification is applicable to coated pipe, steel, concrete and other surfaces listed in the coating schedule at the end of this section. Reservoir painting, pipe corrosion protection systems, galvanizing and anodizing are specified elsewhere within the contract documents.

C. The Coating System Schedules summarize the surfaces to be coated, the required surface preparation and the coating systems to be applied. Coating notes on the drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

D. Related Work Specified in Other Sections -- Shop coatings and/or factory finishes on fabricated or manufactured equipment may be specified in other divisions. Some items with factory finishes, or corrosion resistant finishes may be scheduled or directed to be painted by the ENGINEER to unify a wall finish or color scheme, at the ENGINEER's discretion.

E. Exclusions -- Do not coat the following surfaces unless specified or directed elsewhere: Stainless steel, aluminum, copper, brass, bronze and other corrosion-resistant material (except for valve bodies and piping); Electrical switch-gear and motor control centers having factory finish; Fencing; Multiple coated factory finished baked enamel or porcelain products; Concealed areas such as ducts, piping, conduits and items specified elsewhere for special linings and coatings.

F. Damaged Factory Finish -- If directed by the ENGINEER, refinish the entire exposed surfaces of equipment chipped, scratched or otherwise damaged in shipment or installation.

G. All coating coming in contact with potable water shall be NSF approved.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

1. "Architectural Specification Manual" by the Painting and Decorating Contractors of America (PDCA), 333 Taylor Avenue North, Seattle, Washington 98109.

2. "Systems and Specifications" - Volume 2 of Steel Structures Painting Council (SSPC).

3. National Sanitation Foundation (NSF) Standard No. 61.

B. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers, P.O. Box 986, Katy, TX 77450.

C. Pipe Coating Commercial Standards

ANSI/AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
ANSI/AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
ANSI/AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4-inch and Larger - Shop Applied
ANSI/AWWA C209	Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Pipelines.
ANSI/AWWA C210	Liquid Epoxy Coating for Exterior and Interior of Steel Pipe.
ANSI/AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
ANSI/AWWA C214	Tape Coating systems for the Exterior of Steel Water Pipelines.

D. Federal Specifications

DOD-P-23236A(SH)	Military Specification, Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast.

1.3 CONTRACTOR SUBMITTALS

A. Coating Materials List -- The CONTRACTOR shall provide a coating materials list which indicates the manufacturer and the coating number, keyed to the coating systems

herein. The amount of copies to submit shall be as specified within Section 01100, Special Provisions.

B. Coating Manufacturer's and Applicator Information -- For each coating system to be used the CONTRACTOR shall submit, the following listed data.

1. Manufacturer's data sheet for each product used, including statements on the suitability of the material for the intended use.

2. Manufacturer's instructions and recommendations on surface preparation and application.

3. Colors available for each product and each coat.

4. Compatibility of shop and field applied coatings (where applicable).

5. Material safety data sheet (MSDS) for each product used.

6. The manufacturer’s recommended products and procedures for field coating repairs and field preparation of field cut pipe ends.

7. The name of the proposed coating applicator shop along with certification that the applicator shop is qualified and equipped to apply the coatings systems as specified.

8. Certificate -- Submit manufacturer's certificate of compliance with the specifications and standards signed by a representative in the manufacturer's employ.

9. Samples -- Provide painted surface areas at the job for approval of main color selections, or submit sample on 12-inch sample of substrate using required finish system at ENGINEER’s discretion.

1.4 QUALITY ASSURANCE

A. The CONTRACTOR shall give the ENGINEER a minimum of 3 days advance notice of the start of any field surface preparation work of coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.

B. All such work shall be performed only in the presence of the ENGINEER, unless the ENGINEER has granted prior approval to perform such work in its absence.

C. Inspection by the ENGINEER, or the waiver of inspection of any particular portion of the work, shall not relieve the CONTRACTOR of its responsibility to perform the work in accordance with these Specifications.

D. Surface Preparation -- Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standard TM-01-70.

E. Scaffolding shall be erected and moved to locations where requested by the ENGINEER to facilitate inspection. Additional illumination shall be provided by the CONTRACTOR to cover all areas to be inspected.

F. Paint Products -- No request for substitution shall be approved which decreases the film thickness designated or the number of coats to be applied, or which offers a change from the generic type of coating specified. Painting shall be done at such times as the CONTRACTOR and ENGINEER may agree upon in order that dust-free and neat work be obtained. All painting shall be in strict accordance with the manufacturer's instructions and shall be performed in a manner satisfactory to the ENGINEER.

G. Manufacturer's Representative -- Require coating manufacturer's representative to be at job site when the first day's coating application is in progress and periodically during progress of the work.

H. Labels -- Deliver to the job site in the original sealed containers with manufacturer's name, product name, type of product, manufacturer's specification or catalog number or federal specification number, and instructions for reducing where applicable.

I. Colors -- Colors will be selected from manufacturer's standard colors as reviewed by ENGINEER and approved by the OWNER. Colors for special coatings that are limited in their availability and color selection will be chosen on the basis of manufacturer's standard colors, provided that the manufacturer's product line represents a color range comparable to similar products of other manufacturers.

J. Flame Spread -- Provide paint materials which will result in a Class II finish for all coated surfaces in exit corridors, and a Class III finish for all other interior rooms or areas.

K. Film Thickness Testing -- On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gage such as Mikrotest model FM, Elcometer model 111/1EZ, or approved equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using wet film gage readings and destructive film thickness tests.

L. Inspection Device -- The CONTRACTOR shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. Dry-film thickness gages shall be made available for the ENGINEER'S use at all times while coating is being

done, until final acceptance of such coatings. The CONTRACTOR shall provide the services of a trained operator of the holiday detection devices until the final acceptance of such coatings.

M. Holiday Testing -- The CONTRACTOR shall holiday test all coated ferrous surfaces. Areas which contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested.

1. Coatings With Thickness Exceeding 20 Mils -- For surfaces having a total dry film coating thickness exceeding 20 mils: pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or approved equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

2. Coatings With Thickness of 20 Mils or Less -- For surfaces having a total dry film coating thickness of 20 mils or less: Tinker & Rasor Model M1 nondestructive type holiday detector, K-D Bird Dog, or approved equal shall be used. The unit shall operate at less than 75-volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flo, or equal, shall be added to the water prior to wetting the detector sponge.

1.5 DELIVERY, HANDLING, AND STORAGE

A. Deliver in labeled containers as specified above and store in a locked room accessible for inspection. Comply with fire and health regulations.

B. Provide adequate heat and forced mechanical ventilation for health, safety and drying requirements. Use explosion proof equipment. Provide face masks.

C. Protect adjacent surfaces with suitable masking and drop cloths as required. Remove cloths or waste from the project daily.

D. Apply to surfaces under recommended environmental conditions and within the limitations established by the material manufacturer. Do not apply coating in snow, rain, fog or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces, unless otherwise permitted by the coating manufacturer's printed instructions. Coating application may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

1.6 PROTECTION

A. Follow all safety recommendations of manufacturer regarding ventilation and danger from explosion or breathing paint fumes or skin exposure, and all applicable O.S.H.A. and other regulations.

B. Protect surface adjacent to work being coated from overspray, drips or other damage.

1.7 EXTRA STOCK

Provide one gallon of each type and color, fully labeled, at completion of job.

PART 2 PRODUCTS

2.1 GENERAL

A. Definitions -- The terms "paint," "coatings" or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, tape and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.

B. General -- Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.

C. The CONTRACTOR shall use coating materials suitable for the intended use and recommended by their manufacturer for the intended service.

D. Compatibility -- In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to the approval of the ENGINEER, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

E. Colors -- All colors and shades of colors of all coatings shall be as selected or specified by the ENGINEER. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the ENGINEER. Color pigments shall be lead free.

F. Protective Coating Materials -- Products shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the CONTRACTOR shall provide the ENGINEER with the names of not less than 10 successful applications of the proposed manufacturer's products demonstrating compliance with this specification requirement.

G. Substitute or "Or-Equal" Submittals -- Unless otherwise specified, materials are from the catalogs of the companies listed herein. Materials by other manufacturers are

acceptable provided that they are established as being compatible with and of equal quality to the coatings of the companies listed. The CONTRACTOR shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or equal" material that said material meets the specified requirements and is equivalent or better than the listed materials.

H. The cost of all testing and analyzing of the proposed substitute materials that may be required by the ENGINEER shall be paid by the CONTRACTOR. If the proposed substitution requires changes in the contract work, the CONTRACTOR shall bear all such costs involved and the costs of allied trades affected by the substitution.

2.2 INDUSTRIAL COATING SYSTEMS

A. General

Provide and apply the industrial coatings systems which follow as listed in the coating schedule, as required by these specifications and as directed by the ENGINEER. Coat all existing and new exposed interior or exterior surfaces and submerged and intermittently submerged surfaces as indicated, except as specifically excluded in Part 1 of this section or on the drawings or finish schedules. Coating System Numbers listed below shall be used as the Coating System code letter, and shall be used on any coating submittals or correspondence.

B. Industrial coating systems shall be as follows:

1. Coating System 100

a. Location -- Exposed, unprimed, non-galvanized, nonsubmerged metal surfaces, both interior and exterior including piping and structural steel.

b. Surface Preparation -- As specified herein.

c. Coating System -- Apply prime coat and topcoat, 4.0-6.0 mils each coat of Tnemec Series 66-2 Hi-Build Epoxoline, or approved equal. Color as selected by Owner.

2. Coating System 101

a. Location -- Exposed metal surfaces, shop primed, both interior and exterior including piping, railings, ladders, steel doors, and any other metal items not otherwise specified.

b. Surface Preparation -- As specified herein.

c. Coating System -- Apply shop prime coat 3.0 mils DFT Tnemec Series 90-97 Tneme-Zinc, one coat 4.0 - 6.0 mils DFT Tnemec Series 66 Hi-Build Epoxoline,

and 3.0 - 4.0 mils DFT of Tnemec Series 175 Endura Shield, or approved equal. Color as selected by Owner.

3. Coating System 102

   a. Location -- Unprimed or non-galvanized, continuously or intermittently submerged metal items, both interior and exterior including piping, structural steel and all other metal items not otherwise specified.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Prime, intermediate and topcoat, 4.0-6.0 mils each coat of Tnemec Series 20 Pota-Pox, or approved equal. Color as selected by Owner.

4. Coating System 103

   a. Location -- Vertical concrete walls, exterior, below finish grade, not exposed to view.

   b. Surface Preparation -- As specified herein.

   c. Paint System -- Apply two coats 9.0-10.0 mils each, Carboline Bitumastic 50, or approved equal.

5. Coating System 104

   a. Location - Nonsubmerged, exposed to view, PVC piping.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply one coat, 4.0-6.0 mils Tnemec Series 66-2 Hi-Build Epoxoline, or approved equal. Color as selected by Owner.

2.3 SPECIAL PIPE AND SEVERE SERVICE COATING SYSTEMS

A. General

The following coatings are for buried pipe and surfaces used in severe service conditions. The manufacturers' products listed in this paragraph are materials which satisfy the material descriptions of this paragraph and have a documented successful record for long term submerged or severe service conditions. Proposed substitute products will be considered as indicated within the paragraph entitled " ‘Or-Equal’ Clause” in Section 01 10 00, Summary of Work.

B. Special pipe and severe service coating systems shall be as follows:

1. Coating System 200 -- Cement Mortar Coating

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation - As specified herein.

   c. Coating System -- A 1-1/2-inch minimum thickness mortar coating reinforced with 3/4-inch galvanized welded wire fabric shall be provided. The cement mortar shall contain no less than one part Type V cement to 3 parts sand. The cement mortar shall be cured by a curing compound meeting the requirements of "Liquid Membrane-Forming Compounds for Curing Concrete" ASTM C 309-81, Type II, white pigmented, or by enclosure in an 8-mil thick polyethylene sheet with all joints and edges lapped by at least 6 inches. At the ENGINEER's discretion, the hot applied coal tar epoxy coating may be used as the curing membrane for the mortar coating.

2. Coating System 201 -- Hot Applied Coal Tar Epoxy Coating

   a. Location -- Exterior surface of concrete pipe and cement-mortar coated pipe and fittings.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- The hot applied coal tar epoxy shall be a solvent free 100 percent solids coal tar epoxy chemically compatible with hydrating cement and suitable for application on moist surfaces of freshly placed cement mortar or concrete and properly prepared cured surfaces. The coal tar epoxy coating material shall be Amercoat 1972B or approved equal. The finish coal tar epoxy coating shall have a minimum DFT of 26 mils.

3. Coating System 202 -- Coal-Tar Epoxy Coating System

   a. Location -- Exterior surface of buried steel pipe, fittings and other ferrous surfaces.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- High build, 2-component amine or polyamide cured coal-tar epoxy shall have a solids content of at least 68 percent by volume, suitable as a long term coating of buried surfaces, and conforming to AWWA C210. Prime coats are for use as a shop primer only. Prime coat shall be omitted when both

surface preparation and coating are to be performed in the field. The coal-tar epoxy coating system shall include:

1) Prime coat (DFT = 1.5 mils), Amercoat 83HS, Tnemec P66, or equal.

2) Finish coats (2 or more, DFT = 18 mils), Amercoat 78 HB, Tnemec 46 H-413, or equal.

3) Total system DFT = 19.5 mils.

4. Coating System 203 -- Fusion Bonded Epoxy

   a. Location -- Ferrous surfaces of sleeve couplings, steel pipe and fittings.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- The coating material shall be a 100 percent powder epoxy applied in accordance with the ANSI/AWWA C213 "AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines". The coating shall be applied using the fluidized bed process.

      1) Liquid Epoxy -- For field repairs, the use of a liquid epoxy will be permitted, applied in not less than 3 coats to provide a DFT 16 mils. The liquid epoxy shall be a 100 percent solids epoxy recommended by the powder epoxy manufacturer.

      2) Coating (DFT = 16 mils), Scotchkote 203, or equal.

      3) Total system DFT = 16 mils.

5. Coating System 204 -- Hot, Coal-Tar Enamel

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation - As specified herein

   c. Coating System -- Coal-Tar Enamel materials and procedures shall be in accordance with ANSI/AWWA C203. This system shall consist of a primer layer, coal-tar enamel layer, coal-tar saturated nonasbestos felt outerwrap and a finish coat. Total system DFT = 188 mils.

6. Coating System 205 -- Hot Applied Tape

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation -- As specified herein.

c. Coating System -- Tape coating materials and procedures shall be in accordance with ANSI/AWWA C203. This system shall consist of a cold-applied liquid primer and heated coal-tar base tape. Total system DFT = 50 mils.

7. Coating System 206 -- Cold Applied Tape

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Tape coating materials and procedures shall be in accordance with ANSI/AWWA C209. Prefabricated tape shall be Type II. The system shall consists of a primer layer, inner layer tape of 35 mils, and an outer layer tape of 35 mils. Total system DFT = 70 mils.

8. Coating System 207 -- PVC Tape

   a. Location -- Small galvanized steel pipe and fittings.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Prior to wrapping pipe with PVC tape, the pipe and fittings shall be primed using a primer recommended by the PVC tape manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half lapped for a total thickness of 40 mils.

9. Coating System 208 -- Mastic

   a. Location -- Pipe and fitting joints, and general buried surface coating repair and touch up.

   b. Surface Preparation - As specified herein.

   c. Coating System -- Mastic shall be a one-part solvent drying heavy bodied thixotropic synthetic elastomeric coating with chemically inert resins and fillers and an average viscosity of 650,000 CPS at 77 degrees Fahrenheit, thereby requiring generous applications by hand or trowel. Total coat thickness shall be 30 mils, minimum. Mastic shall be Protecto Wrap 160 H or approved equal and be fully compatible with pipeline coating systems.

10. Coating System 209 -- Polyethylene Encasement

    a. Location -- Ductile iron, steel and concrete cylinder pipe and fittings

    b. Surface Preparation -- None required.

c. Coating System -- Except as otherwise specified, application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C.

2.4 ARCHITECTURAL COATING SYSTEMS

A. General

"Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or topcoat.

Fungus Control: Submit evidence for all paints attesting the passing of Federal Test Method Standard No. 141, Method 6271.1 showing no fungus growth or other approved test results.

Apply to surfaces under recommended environmental conditions and within the limitations established by the material manufacturer. Acrylics require 60 degrees Fahrenheit (°F) and above temperature and below 50 percent relative humidity. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50°F and 90°F unless otherwise permitted by the paint manufacturer's printed instructions.

B. Architectural coating systems shall be as follows:

1. Coating System 300

   a. Location -- Vertical, exterior concrete masonry unit walls exposed to view.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply prime, intermediate and top coat, 75 ft^2/gal, 100 ft^2/gal and 100 ft^2/gal respectively for each coat of Tnemec Series 156 Envirocrete or approved equal. Color as selected by Owner.

2. Paint System 301

   a. Location -- Vertical concrete exterior walls and flat concrete exterior roofs and slabs exposed to view.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply two coats 6.0-9.0 mils (100 ft^2/gal) each coat, Tnemec Series 156 Envirocrete, or approved equal. Color as selected by Owner.

3. Paint System 302

    a. Location -- Interior concrete masonry unit walls and interior and exterior wood walls, ceilings and other wood surfaces not otherwise specified, exposed to view.

    b. Surface Preparation -- As specified herein.

    c. Coating System -- Prime as specified by coating manufacturer. Apply two coats 6.0 - 9.0 mils (100 ft^2/gal) each coat, Tnemec Series 156 Envirocrete, or approved equal. Color as selected by Owner.

4. Paint System 303

    a. Location -- Wood surfaces not otherwise specified, exposed to view.

    b. Surface Preparation -- As specified herein.

    c. Coating System -- Apply an alkyd primer as recommended by the manufacturer, 2 mils. Apply finish coats (two or more coats 6 mils total) of single component, water based acrylic latex coating, Tnemec Series 6, Carboline 3350 or equal. Total DFT = 8 mils. Color as selected by Owner.

5. Paint System 304

    a. Location -- Interior drywall surfaces not otherwise specified, exposed to view.

    b. Surface Preparation - As specified herein.

    c. Coating System -- Apply two coats 2.0 - 3.0 mils each coat of single component, water based acrylic latex coating, Tnemec Series 6, Carboline 3350 or equal. Color as selected by Owner.

6. Paint System 305

    a. Location -- Exterior brick surfaces not otherwise specified, exposed to view.

    b. Surface Preparation -- Surfaces shall be cleaned with a manufacturers approved chemical cleaner and power washed. Surfaces shall be completely dry, free from efflorescence, oils, paint and other contaminants before the coating system is applied. Coating system shall be applied according to the manufacturers published recommendations. A manufacturer's representative shall be present during application of the coating system, if required by the manufacturer's warranty.

c. Coating System -- Apply two coats of masonry water retardant material. The system shall be clear, non-staining, silane-modified-siloxane, Fabrishield 161, Rainstopper 1500, or equal. The selected coating system shall provide a minimum of a five-year manufacturer's warranty.

PART 3 EXECUTION

3.1 STORAGE, MIXING AND THINNING OF MATERIALS

A. Manufacturer's Recommendations -- Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

B. All protective coating materials shall be used within the manufacturer's recommended shelf life.

C. Storage and Mixing -- Coating materials shall be protected from exposure to cold weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.2 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification.

1. Solvent Cleaning (SSPC-SP1) -- Removal of oil, grease, soil, salts and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion or steam.

2. Hand Tool Cleaning (SSPC-SP2) -- Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.

3. Power Tool Cleaning (SSPC-SP3) -- Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing and grinding.

4. White Metal Blast Cleaning (SSPC-SP5) -- Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.

5. Commercial Blast Cleaning (SSPC-SP6) -- Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.

6. Brush-Off Blast Cleaning (SSPC-SP7) -- Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust and loose paint.

7. Near-White Blast Cleaning (SSPC-SP10) -- Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.

8. High- and Ultra High- Pressure Water Jetting (SSPC-SP12): Water jetting at high- or ultra-high-pressure to prepare a surface for recoating using pressure above 10,000 psi.

9. Surface Preparation of Concrete (SSPC-SP-13) - Surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems.

10. Industrial Blast Cleaning (SSPC-SP14): Blast cleaning to remove all visible oil, grease, dust and dirt, when viewed without magnification

3.3 CORRECTIONS AND CLEANUP

At completion any damaged, de-laminated or defaced coated surfaces shall be touched up, restored and left in first class condition. Any coated or finished surfaces damaged in fitting or erection shall be restored. If necessary, an entire wall shall be refinished rather than spot finished. Upon completion and prior to final acceptance, all equipment and unused materials accumulated in the coating process shall be removed from the site and any spillage, spatter spots or other misplaced coating material shall be removed in a manner which will not damage surfaces. Perform required patching, repair and cleaning to the satisfaction of the ENGINEER. Cooperate and coordinate work with the work of other trades in the removal and replacement of hardware, fixtures, covers, switch plates, etc., as required for coating.

3.4 SURFACE PREPARATION

A. General

Prepare all surfaces scheduled to receive new coating systems, as required to provide for adequate bonding of the specified coating system to the substrate material. Request review of prepared surfaces by the ENGINEER prior to proceeding. For existing coated surfaces, hand wash with cleaner or product recommended by coating manufacturer to properly prepare existing surface and provide for bonding of coating specified to follow. Remove any loose, peeling or flaking coating, or mildewed areas. Surface preparation minimums shall be as follows:

1. Exposed metal items, non-submerged, unprimed, non-galvanized both interior and exterior, including: piping, structural steel and all other metal items not otherwise

specified, shall undergo surface preparation in accordance with SSPC-SP6, "Commercial Blast Cleaning".

2. Exposed metal items, shop primed, both interior and exterior including: piping, steel doors, steel ladders to be painted, and railings, and all other metal items not otherwise specified, shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning"; SSPC-SP2, "Hand Tool Cleaning"; and SSPC-SP3, "Power Tool Cleaning" as may be required to remove grease, loose or peeling or chipped paint.

3. Metal items, unprimed or non-galvanized, continuously or intermittently submerged, both interior and exterior including: piping, structural steel and all other metal items not otherwise specified, shall undergo surface preparation in conformance with SSPC-SP10, "Near-White Blast Cleaning".

4. Stainless Steel – Non-submerged and submerged, exposed piping and fittings, both interior and exterior shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning".

5. Polyvinyl Chloride (PVC) – Non-submerged, both interior and exterior, process piping and plumbing, shall be lightly sanded prior to application of the specified coating system to follow.

6. Non-submerged Concrete - Clean all concrete surfaces of dust, form oil, curing compounds or other incompatible matter. Etch and prime if required by manufacturer for specified coating products to follow. Allow minimum 28-day cure of concrete prior to application of coating systems.

3.5 PRIME COATING

A. Exposed Steel -- Prime coat all exposed steel in accordance with SSPC PS 13.01 for epoxy-polyamide coating systems. Prime coats shall be applied following completion of surface preparation requirements as specified in paragraph 3.4.A.1 above.

B. Galvanized Metal -- After surface preparation specified above, prime galvanized metal items receiving paints as specified with Tnemec Series 66 Hi-Build Epoxaline or equal, verifying with manufacturer before application the compatibility with coatings specified to follow.

C. Shop Primed Metal -- Where indicated on the plans or coating schedule and following the surface preparation procedures specified in paragraph 3.4.A.2 above, the CONTRACTOR shall apply intermediate and topcoats of the specified paint system to shop primed metal. The CONTRACTOR shall verify with the manufacturer(s) representative of the item(s) to be painted, before application, the compatibility of shop primers with the specified intermediate and topcoat coating systems.

D. Non-Shop Primed Metal and Piping -- Prime coat all exposed metal and piping, except stainless steel, received at job site following completion of surface preparation requirements as specified in paragraph 3.4.A.1 above. Prime paint in accordance with SSPC PS No. 13.01 for epoxy-polyamide primers. Epoxy-polyamide primers shall conform to the standards set forth in SSPC Paint Specification No. 22.

3.6 FIELD PRIME

Wherever shop priming has been damaged in transit or during construction, the damaged area shall be cleaned and touched up with field primer specified herein or returned to the shop for resurfacing and repriming, at the ENGINEER’s discretion. Metal items delivered to the job site unprimed shall be cleaned and primed as specified herein.

3.7 APPLICATION

A. Thickness -- Apply coatings in strict conformance with the manufacturer's application instructions. Apply each coat at the rate specified by the manufacturer to achieve the dry mil thickness specified. If material must be diluted for application by spray gun, build up more coating to achieve the same thickness as undiluted material. Correct apparent deficiency of film thickness by the application of an additional coat.

B. Porous Surfaces -- Apply paint to porous surfaces as required by increasing the number of coats or decreasing the coverage as may be necessary to achieve a durable protective and decorative finish.

C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

D. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

E. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe coating for these areas.

F. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

G. Ventilation -- Adequately ventilate enclosed rooms and spaces during painting and drying periods.

H. Drying Time -- Do not apply next coat of coat until each coat is dry. Test non-metallic surfaces with moisture meter. The manufacturer's recommended drying time shall mean an interval under normal condition to be increased to allow for adverse weather

or drying conditions. Coating manufacturer's representative shall verify by cure testing, complete cure of coatings systems used for immersion service.

3.8 COATING SCHEDULE

Coating Schedule

Item	Location	Material	Coating System
Piping	Inside Pump Stations (exterior surface)	Steel	Coating System 100
Piping	Under Reservoir, buried (interior surface)	Steel	Coating System 101
Piping	Under Reservoir, buried (exterior surface)	Ductile Iron	Coating System 101
Piping	Vaults (exterior surface)	Ductile Iron	Coating System 100
* Handrails/ Guardrails & Ladders	Exterior Reservoir	Steel	Coating System 101
Ladders	Interior Reservoir	Steel	Coating System 102
Vertical Walls	Vaults	Concrete	Coating System 103
Piping	Yard, Buried	Ductile Iron	Coating System 209

* Where handrails are to be field welded, taper paint layers back from welded end. Leave each layer approximately 6 inches back from previous layer. Provide sufficient exposed length of railing as to not cause damage from field welding to shop prime/paint.

NOTES: 1. Fusion bonded epoxy [ANSI/AWWA C213] can be substituted for coal tar epoxy. Potable water epoxy, NSF approved, shall be used for all surfaces in contact with potable water.

END OF SECTION

SECTION 09 97 14

STEEL WATER STORAGE TANK PAINTING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes preparing, priming, and installing protective paint systems for welded steel potable water storage tanks and associated piping.

B. Section Includes:

1. Surface preparation.
2. Painting tank interior and exterior.

C. The new reservoir is described as follows:

1. Owner: Lewis County, Washington

2. Location: 1333 South Military Rd., Vader, WA 98596 North of the City of Vader. See Cover Sheet.

3. Function: Potable water reservoir

4. Reservoir Name: New Vader Reservoir

5. Nominal Volume: 250,000 gallons

6. Dimensions (approximate): 55 feet in diameter; 20 feet in height (shell height)

7. Year of construction: 2018.

D. The existing reservoir is described as follows:

1. Owner: Lewis County, Washington

2. Location: 1333 South Military Rd., Vader, WA 98596 North of the City of Vader. See Cover Sheet.

3. Function: Potable water reservoir

4. Reservoir Name: Existing Reservoir

5. Nominal Volume: 250,000 gallons

6. Dimensions (approximate): 55 feet in diameter; 16 feet in height (shell height)

7. Year of construction: 1979

8. Interior coating system: Not known to be lead-based.

9. Exterior coating system: Not known to be lead-based.

E. Extent of Work:

1. Surface preparation and application of a protective paint system to the new steel reservoir interior surfaces.

2. Humidity and temperature control for the interior coating work.

3. Surface preparation and application of a protective paint system to the new steel exterior surface.

4. Surface cleaning of the interior and existing reservoir exterior steel surfaces by waterjet cleaning.

5. Spot coating repairs to the interior and exterior steel reservoir surfaces.

6. Installation of a non-skid surface on portions of the new reservoir roof.

F. Related Work Specified in Other Sections:

1. Surface preparation and application of specified coatings systems in this Section are in addition to shop-priming and surface treatment that may be specified under other sections of the Work or furnished with manufactured equipment.

2. Some items with factory finishes or corrosion-resistant finishes may be scheduled or directed to be painted by the ENGINEER to unify a finish or color scheme at the ENGINEER'S discretion.

3. Paint all exposed surfaces whether or not colors are designated in "schedules", except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the ENGINEER will select these from standard colors available for the materials systems specified.

G. Exclusions:

1. Do not paint the following surfaces unless specified or directed elsewhere: Stainless steel, aluminum, copper, brass, bronze and other corrosion-resistant materials (except for valve bodies and piping); multiple-coated factory-finished baked

enamel or porcelain products; concealed areas such as ducts, piping, conduits and items specified elsewhere for special linings and coatings.

2. Do not paint any surfaces scheduled for special coating or waterproofing systems in other sections of the specifications.

1.2 RELATED SECTIONS

A. Section 05 50 00 – Metal Fabrications.
B. Section 07 92 10 - Sealants and Caulking for Steel Reservoirs.
C. Section 33 01 13.13 – Rehabilitation of Steel Aboveground Water Utility Storage Tanks
D. Section 33 13 13 - Water Storage Tank Disinfection.
E. Section 33 16.13.13 – Steel Aboveground Water Utility Storage Tanks

1.3 REFERENCE STANDARDS

A. General:

1. Without limiting the general aspects or other requirements of this Section, Work and equipment shall conform to any applicable requirements of municipal, state and federal codes, laws and ordinances governing the Work, standard specifications, and the paint manufacturer's printed instructions and guidance documentation.

2. The decision of the ENGINEER shall be final as to the interpretation of any codes, laws, ordinances, instructions, guidance documentation, specifications and standards referenced or contained herein and the resolution of any conflicts between any documents.

B. American Water Works Association:

1. AWWA D102 - Coating Steel Water Storage Tanks.

C. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.

D. SSPC: The Society for Protective Coatings:

1. Good Painting Practice, SSPC Painting Manual, Volume 1.
2. Specifications and Systems, SSPC Painting Manual, Volume 2.

E. Published standards of National Association of Corrosion Engineers (NACE) pertaining to coating and coating inspections.

F. Code of Federal Regulations (CFR)

1. 29 CFR 1910 Occupational Safety and Health Standards (General Industry Standards)

2. 29 CFR 1926.62, Lead in Construction

1.4 DEFINITIONS

A. Coating Systems: Protective paint systems consisting of primer, intermediate coat(s) and finish-top coats.

B. Exterior Surfaces: All outside surfaces of the reservoir. Exterior surfaces include the reservoir roof; the reservoir exterior shell; all exterior ladders and ladder cages; vents; piping; roof hatches; sidewall manway access hatches; and any other exterior appurtenances and surfaces not specifically excluded by this Section or elsewhere in these Specifications to receive the specified paint system.

C. Interior Surfaces: All surfaces contained within the inside of the reservoir which have contact with the stored fluid or the humid atmosphere above the stored fluid. Interior surfaces include the reservoir ceiling and associated structural supports, including joists and columns; reservoir interior shell; reservoir floor; interior ladders; overflow and associated piping; the interior of the center roof support column and exterior of all pipes located within the center roof support column; and any other interior surfaces not specifically excluded by this Section or elsewhere in these Specifications to receive the specified paint system.

D. Paints: All coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or topcoat.

1.5 PREINSTALLATION MEETINGS

A. Convene minimum one week prior to commencing Work of this Section.

1. To be held with the OWNER, CONTRACTOR, ENGINEER, and paint manufacturers' representative present.

2. Review minimum acceptable atmospheric conditions under which the specified paint systems can be applied.

3. Low and high temperature limits for application work shall be determined at the sole discretion of the ENGINEER at this time.

1.6 PAINT AND COATING SYSTEMS MANUFACTURER

A. Provide the paints and coatings specified herein. Paint application shall be in strict accordance with the manufacturer's printed instructions.

B. Paint Products:

1. All paint products shall be from a single manufacturer.

2. No request for substitution shall be approved which decreases the film thickness designated or the number of coats to be applied, or which offers a change from the generic type of coating specified.

3. Painting shall be done at such times as the CONTRACTOR and ENGINEER may agree upon in order that dust-free and neat work is achieved.

4. All painting shall be in strict accordance with the manufacturer's instructions and shall be performed in a manner satisfactory to the ENGINEER.

C. Manufacturer's Representative:

1. Provide a paint manufacturer’s representative and require paint manufacturer's representative to be at job site for a pre-job conference, when surface preparation is underway, when the first day's painting is in progress and periodically during progress of the work.

D. Paint Labels:

1. Deliver paint to Site in the original sealed containers with manufacturer's name, product name, type of product, manufacturer's specification or catalog number or federal specification number, and instructions for reducing where applicable.

E. Paint Colors:

1. Colors will be selected from manufacturer's standard colors as reviewed by ENGINEER and approved by the OWNER.

2. Colors for special coatings that are limited in their availability and color selection will be chosen on the basis of manufacturer's standard colors, provided that the manufacturer's product line represents a color range comparable to similar products of other manufacturers.

1.7 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Materials List: Submit a list of materials and manufacturer's standard color chart and manufacturer's technical information including analysis and application information for each material proposed for use, federal specification number, and cross references to the specifications. Clearly identify and label each paint system with designated specification number and, within each system, identify and label the product designated for first coat and each additional coat. Submit product data/information sheets for all products proposed for use.

C. Manufacturer's Application Instructions and Surface Preparation Recommendations: Submit manufacturer's application instructions and surface preparation recommendations for use and reference at the project site.

D. Safety Data Sheets (SDS): Submit SDS's for all products proposed for use, including paint systems, solvents, thinners and mineral spirits to be used for degreasing, surface preparation and thinning of paint systems for review by the ENGINEER and approval by the paint manufacturer's representative. Applicable SDS's shall be kept on the Site for the entire time such products are present on the Site.

E. Certificate: Submit manufacturer's certificate of compliance with the specifications and standards signed by a representative in the manufacturer's employ who is authorized by the manufacturer to execute the certificate.

F. Samples:

1. Submit two paper chip samples, 2 inches square, illustrating range of colors available for each scheduled surface finishing product. The ENGINEER may request additional samples on 12-inch square section of substrate using the required finish system.

2. Provide a representative sample of sand to be used for any required non-skid surfaces.

G. Submittal Documents: Submit the above-specified materials in a single project submittal with all materials loose-leaf in 3-ring binders and an electronic copy.

H. Field Quality-Control Submittals:

1. Indicate results of Contractor-furnished tests and inspections including, but not limited to, ambient environmental conditions, surface profile measurements, DFT measurements, etc.

2. Provide letters of coating application acceptance from paint and coating systems manufacturer representative.

3. Provide certification letters from NACE Certified Level 2 Coating Inspector and surface preparation conformance with Specifications for any shop-coating procedures performed as may be applicable to the project.

I. Existing Lead-Based Paint Testing, Removal, Containment, Disposal and Environmental and Personnel Protection Plans:

1. Lewis County has tested the exterior of the existing reservoir for lead. Results of the testing did not indicate the presence of lead.

1.8 QUALITY ASSURANCE

A. Comply with AWWA D102

B. Materials in Contact with Potable Water: Certified to NSF 61.

C. Obtain paint products from single source for Work specified in this Section.

D. Provide all testing equipment and conduct Field Quality Control procedures as specified in Part 3 of this Section.

1.9 PAINT DELIVERY, HANDLING AND STORAGE

A. Container Labeling: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

B. Inspection:

1. Accept materials on Site in manufacturer's sealed and labeled containers.
2. Inspect for damage and to verify acceptability.

C. Store materials in ventilated area and otherwise according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Provide additional protection according to manufacturer instructions.

1.10 SAFETY AND HEALTH REQUIREMENTS

A. Comply with all applicable Oregon OSHA, EPA, and DEQ regulations relating to painting/coating preparation, application and all associated activities.

B. Conform to all applicable safety requirements set forth by manufacturer's printed instructions and applicable technical bulletins and manuals.

C. Provide and require the use of personal protective life-saving equipment for persons working within or about the Site.

D. Ladders, Scaffolding and Rigging:

1. All ladders, scaffolding and rigging shall be designed for their intended uses.

2. Ladders and scaffolding shall be erected where requested by ENGINEER to facilitate inspection and be moved by the CONTRACTOR to locations requested by the ENGINEER.

E. Ventilation:

1. Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof.

2. Ventilation accomplished by educting air, vapors, and other hazardous material from the confined space shall be conducted to reduce the concentration of air contaminants to the degree a hazard does not exist.

3. Forced air eduction during blast cleaning and coating application operations is mandatory.

4. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.

F. Protective Equipment:

1. Provide for the duration of the coating/painting operations suitable personal breathing apparatus, protective clothing and safety gear for the use of the ENGINEER’s on-site representative.

2. All such equipment shall be provided and maintained in excellent working order and shall be available at all times during painting and coating operations.

G. Grounding: Blasting, spray and air hoses shall be grounded to prevent accumulation of charges of static electricity.

H. Illumination:

1. Spark-proof artificial lighting shall be provided for all work in confined spaces. Light bulbs shall be guarded to prevent breakage.

2. Lighting fixtures and flexible cords shall comply with the requirements of NFPA 70: National Electric Code for the atmosphere in which they will be used.

3. Whenever required by the ENGINEER, the CONTRACTOR shall provide additional illumination and necessary supports to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the ENGINEER.

I. Solvents:

1. The solvents used with specified protective coatings may be explosive at low concentrations and may be highly toxic. Because of toxicity, the maximum allowable concentration of vapor shall be kept below the maximum safe concentration for eight-hour exposure and the lower explosive limit (LEL) must be strictly adhered to.

2. If existing coatings or paints to be removed contain lead or other hazardous materials, all regulations related to safety of personnel and handling of such materials shall be strictly adhered to.

J. Mixing and Application of Coatings and Paints:

1. During mixing and application of coatings and paints, all flames, welding and smoking shall be prohibited in the vicinity.

2. When handling and mixing coatings and paints, workers shall wear gloves and eye shields.

3. Fire extinguishers of the appropriate type shall be provided by CONTRACTOR and kept at the project site during all operations.

K. Noise: Whenever the occupational noise exposure exceeds the maximum allowable sound levels, the CONTRACTOR shall provide and require the use of approved ear protective devices.

L. Notification to Public: Notify all adjoining property owners within twenty-four (24) hours of any and all on-site surface preparation and/or painting activities.

M. Dust Prevention and Control: Applicable environmental regulations for dust prevention shall be strictly enforced. Emissions from reservoir construction activities including abrasive blasting and painting shall be controlled to be within applicable environmental regulations.

1. Where a reservoir may be located in close proximity to existing residential, commercial, or industrial development, conduct all operations so as to confine abrasive blasting debris and paint overspray to within the bounds of the Site. Take

all precautions necessary to prevent adverse off-site consequences of painting operations.

2. Any complaints received by the OWNER or ENGINEER shall be delivered to the CONTRACTOR for resolution. The CONTRACTOR shall immediately halt the work and shall take whatever corrective action is required to mitigate any such problems.

3. All costs associated with protection of off-site properties and/or correction of damage to property as a result of painting operations shall be borne directly by the CONTRACTOR at no additional expense to the OWNER.

1.11 AMBIENT CONDITIONS

A. Do not apply paint in rain, snow, fog or mist, or when steel surface temperature is below dew point as specified by coating manufacturer which will result in condensation.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges indicated by paint product manufacturer.

C. Prevent rapid changes in temperature during curing and thermal shock cracks in finish material.

1.12 WARRANTY

A. A warranty inspection will be conducted between the tenth and twelfth months following completion and acceptance of all coating and painting work. The OWNER, the ENGINEER, the CONTRACTOR shall be present at this inspection.

B. All defective work found in the warranty inspection shall be repaired at the sole cost of the CONTRACTOR in strict accordance with this Section and to the satisfaction of the ENGINEER.

C. The warranty inspection shall consist of the following:

1. The OWNER shall establish the date for the inspection and shall notify the CONTRACTOR at least 30 days in advance.

2. Interior Coating Systems:

a. The entire interior coating systems, as installed under this Project, shall be visually inspected.

b. If additional inspection is deemed necessary by the ENGINEER, such inspection shall be accomplished as directed in accordance with the applicable provisions of this Section.

c. All defective coating, as well as damaged or rusting spots of the reservoir, shall be satisfactorily repaired by and at the sole expense of the CONTRACTOR.

d. All repaired areas shall then be electrically tested as specified in the Field Quality Control procedures within Part 3 of this Section.

3. Exterior Coating Systems:

a. The entire exterior paint system, as installed under this Project, shall be visually inspected.

b. If additional inspection if deemed necessary by the ENGINEER, such inspection shall be accomplished as directed in accordance with the application provisions of this Section.

c. All defective, damaged or rusting areas shall be satisfactorily repaired by and at the sole expense of the CONTRACTOR.

4. The ENGINEER will prepare and deliver to the CONTRACTOR an inspection report covering the first anniversary inspection, setting forth the number and type of failures observed, the percentage of the surface area where failure has occurred, and the names of the persons making the inspection.

5. Upon completion of inspection and receipt of the inspection report as noted herein, the OWNER shall establish a date for the CONTRACTOR to proceed with remedial work. Any delay on part of the CONTRACTOR to meet schedule established by the OWNER shall constitute breach of this Contract and OWNER may proceed to have defects remedied as outlined in the General Conditions.

6. Any location where the coating or paint has peeled, bubbled, or cracked and any location where rusting is evident shall be considered to be a failure of the system. The CONTRACTOR shall make repairs at all points where failures are observed by removing the deteriorated coating or paint, cleaning the surface, and recoating or repainting with the same system. If the area of failure exceeds 25 percent of the total coated or painted surface, the entire coating or paint system may be required to be removed and recoated or repainted in accordance with the original specification.

7. All costs for the warranty inspection and all costs for repair shall be borne by the CONTRACTOR. The CONTRACTOR shall reserve an appropriate amount for inspection, testing, repair and disinfection as no additional allowance will be paid by the OWNER for the warranty inspection and repair.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

A. Schedules:

1. Paint systems, surface treatments, and finishes are indicated in the "Schedules" of the contract documents or as described in this Section.

2. Prior to beginning work, the ENGINEER will furnish color schedule for surfaces to be painted.

3. Vary undercoats slightly from color of next coat.

4. The color schedule will consist of colors as selected by the OWNER and approved by the ENGINEER and from approved submittals, at the ENGINEER'S discretion.

B. Quality:

1. Provide the best quality grade of the various types of coatings as regularly manufactured by acceptable paint materials manufacturers.

2. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.

C. Paint Coordination:

1. Provide topcoats which are compatible with prime coats used on the Project or which are compatible with existing topcoats on existing facilities.

2. Review other sections of these Specifications in which prime coats are to be provided to ensure compatibility of total coatings system for various substrates.

3. Upon requests from other trades, furnish information on the characteristics of finish materials proposed for use, to ensure compatible prime coats are used.

4. Provide barrier coats over incompatible primers or remove the primer and re-prime as required.

5. Notify the ENGINEER in writing of any anticipated problems using specified coating systems with substrates primed by others or on existing finishes.

D. Proprietary names used to designate colors, materials, or equipment are not intended to imply that products of the named manufacturers are required to the exclusion of equivalent products, materials, equipment and equal color ranges of other manufacturers.

E. Federal Specifications, where used, establish the minimum acceptable quality for paint materials. Provide a written certification from the paint manufacturer that materials provided meet or exceed these minimums.

F. Color Pigments:

1. Color pigments shall be pure, non-fading, and applicable and suitable to the substrates and services indicated.

2. Pigments shall be lead free.

G. Use only thinners approved by the paint manufacturer and only within recommended limits.

2.2 SURFACE PREPARATION MATERIALS

A. Abrasives

1. Abrasives used in blast cleaning operations shall be clean, well graded, non-metallic and free of contaminants which would interfere with adhesion of the coatings to the substrate material.

2. Selection of abrasive size and type shall be based upon the type, grade and surface condition of the steel to be cleaned and on the finished surface to be produced for the subsequent paint system.

3. Blast cleaning abrasives shall meet or exceed the following minimum criteria:

Description	Criteria
Hardness (Mohr Scale)	8
Shape	Angular
Specific Gravity	3.3
Bulk Density (1lbs/cu. ft.)	110
Free Silica (% by wt.)	0

4. Blast cleaning abrasive particle size shall be that which will produce a 2.0 mil (.002 inch) anchor profile on the substrate metal or in accordance with recommendations of the manufacturers of the specified coating system to be applied, subject to approval by the ENGINEER.

5. Blast cleaning abrasive manufacturer:

a. Blast cleaning abrasives shall be Kleen Blast Abrasive as manufactured by Kleen Blast, Green Diamond Abrasive as manufactured by Green Diamond Sand Products or approved equal.

6. Lead Stabilizing Additives: For coatings containing lead removed by blast cleaning, a lead stabilizing abrasive additive shall be used in concentrations recommended by the additive manufacturer. Lead stabilizing additive shall be Blastox as manufactured by The TDJ Group, Fesi-Bond as manufactured by Green Diamond Sand Products, or approved equal.

B. Waterjet Wash Solutions: Solutions shall consist of a 5% concentration of tri-sodium phosphate (TSP).

C. Tool Cleaning: Hand and power tools shall be used to adequately prepare surface areas per surface preparation specifications methods specified herein.

2.3 INTERIOR PAINT SYSTEMS

A. General:

1. Interior paint systems for wet surfaces of tanks must have been approved by the National Sanitation Foundation (NSF) under Standard 61 for indirect additives.

2. The paint systems shall conform to regulations and applicable requirements of local, State and Federal air pollution regulatory agencies.

3. Products containing perchloroethylene will not be permitted.

B. Interior paint systems shall consist of a zinc/epoxy system.

1. In accordance with AWWA Standard D102, Inside Coating System No. 5 for surfaces above the water line.

2. In accordance with AWWA Standard D102, Inside Coating System No 2 for surfaces below the water line.

C. Coatings and sequence of their application shall be as described below:

1. Prime coat for ceiling and associated support system including joists, columns, overflow and associated piping, and walls from the ceiling down to a level two (2) feet below the lowest normal reservoir operating level:

a. Material: Zinc-rich urethane.

1) Tnemec Series 94-H2O, Hydro Zinc, Zinc-rich urethane primer.
2) Approved equal.

b. Dry Film Thickness: 2.5 to 3.5 mils.

c. Color: White.

d. Project Specific: The lowest normal reservoir operating level is 8 feet below the reservoir ceiling at the reservoir shell; therefore, this prime coat shall be carried 10 feet below reservoir ceiling at the reservoir shell.

2. Prime coat for remainder of interior surfaces including walls, floor, columns, pipes and ladders:

   a. Material: Polyamide epoxy.

      1) Tnemec Series 20 Pota-Pox
      2) Approved equal.

   b. Dry Film Thickness: 3.0-4.0 mils

   c. Color: White.

3. Intermediate coat for all primed surfaces:

   a. Material: Polyamide epoxy.

      1) Tnemec Series 20 Pota-Pox.
      2) Approved equal.

   b. Dry Film Thickness: 4.0-5.0 mils.

   c. Color: Light blue or Beige.

   d. All weld seams and pitted areas shall be back-rolled or brushed with the intermediate coat.

4. Finish coat for all interior surfaces:

   a. Material: Polyamide epoxy.

      1) Tnemec Series 20 Pota-Pox
      2) Approved equal.

   b. Dry Film Thickness: 4.0-5.0 mils.

   c. Color: White.

5. The completed finished coating system on the ceiling and associated support system including columns, overflow and associated piping, and walls from the ceiling down to a level that is two (2) feet below the lowest normal reservoir operating level as defined in Paragraph 2.3.C.1 above shall be 10.5- 13.5 mils DFT minimum. The completed finished coating system on all other interior surfaces shall be 11.0-14.0 mils DFT minimum.

D. Fast-cure versions of the paint products specified above may be substituted upon approval from the ENGINEER.

2.4 EXTERIOR PAINT SYSTEMS

A. Existing Reservoir:

1. Conform to the regulations and applicable requirements of local, State and Federal air pollution regulatory agencies.

B. Exterior paint systems shall consist of a moisture-cured high solids sealer/urethane system.

C. Coatings and sequence of their application shall be as described below:

1. Exterior Spot Primer:

a. Material: Polyamide epoxy or approved equal material

1) Tnemec Series 27 F.C. Typoxy.
2) Approved equal.

b. Dry Film Thickness: 2.0 to 3.0 mils.

2. Full Prime Coat:

a. Material: Polyamide epoxy or approved equal material.

1) Tnemec Series 27 F.C. Typoxy.
2) Approved equal.

b. Dry Film Thickness: 1.5 to 2.0 mils.

c. Color: One shade lighter than the top coat.

3. Finish Top Coat:

a. Material: Acrylic polyurethane enamel

1) Tnemec Series 73, Endura-Shield.
2) Approved equal.

b. Dry Film Thickness: 2.0 to 3.0 mils.

c. Color: As selected by the OWNER to match the existing reservoir. Confirm color with OWNER and ENGINEER prior to ordering.

4. The completed finished coating system over existing exterior surface and appurtenances shall be between 3.5 and 5.0 mils DFT. The completed finished coating system on spot primed areas shall be between 6.5 and 8.0 mils DFT.

D. New Reservoir:

1. Conform to the regulations and applicable requirements of local, State and Federal air pollution regulatory agencies.

E. AWWA OCS-6 Exterior paint systems shall consist of an organic zinc /epoxy/urethane system.

F. Coatings and sequence of their application shall be as described below:

1. Prime Coat:

a. Material: Zinc-rich urethane.

1) Tnemec Series 94-H_2O, Hydro Zinc, Zinc-rich urethane primer.
2) Approved equal.

b. Dry Film Thickness: 2.5 to 3.5 mils.

c. Color: Same as shop coat

2. Intermediate Coat:

a. Material: Epoxy.

1) Tnemec Series 27 F.C. Typoxy.
2) Approved equal.

b. Dry Film Thickness: 3.0 to 5.0 mils.

c. Color: One shade lighter than the top coat.

3. Finish coat

a. Material: Acrylic polyurethane enamel.

1) Tnemec Series 73, Endura-Shield.
2) Approved equal.

b. Dry Film Thickness: 3.0 to 5.0 mils.

c. Color: As selected by the OWNER. Confirm color with OWNER prior to ordering.

4. Finished coating system on exterior surface and appurtenances shall be between 8.5 and 13.5 mils dry film thickness.

G. Compatible accelerators may be used as recommended by manufacturer and as approved by ENGINEER. All such accelerators must be produced by the same manufacturers as the paint products.

H. Non-Skid Surface

1. Material: Natural, clean sand, free of soil and other deleterious material, having hard, durable grains with 100% passing the No. 4 sieve.

2.5 WATERJET CLEANING EQUIPMENT

A. Performance Criteria:

1. Deliver a flow rate of 3.5 gallons per minute (gpm) at a pressure of 3,000 pounds per square inch (psi).

2. Nozzle manufacture and geometry shall provide a rotating nozzle which directs the high-pressure spray at a 90-degree angle to the axis of the pressure wand.

2.6 MOISTURE CONTROL EQUIPMENT

A. Moisture control equipment shall be used on Project to complete the specified interior surface preparation and coating as specified herein.

B. Dehumidifier:

1. Design: Solid desiccant design having a single rotary desiccant bed capable of continuous operation with fully automatic operation. No liquid desiccant, granular or loose lithium chloride drying systems shall be accepted.

2. Performance Criteria:

a. Continuously deliver air with a maximum relative humidity of 11%.

b. Supply the space with two complete air changes per hour.

c. Supply sufficient dry air to assure that the air adjacent to the surfaces to be abrasive blasted or coated shall not exceed 35% relative humidity at any time during the blasting, coating or curing cycle.

d. Capable of depressing the dew point in the space 10 degrees F below ambient air temperature within twenty minutes.

2.7 HEATING EQUIPMENT

A. Auxiliary heaters or chillers may be necessary to maintain the surface temperature at a level acceptable to the coating manufacturer's application parameters.

B. Coordination with Dehumidification Equipment:

1. Heating equipment must be coordinated with and approved for use by the manufacturer of the dehumidification equipment.

2. If is necessary to filter the air escaping the space, the filtration system must be designed to match the air volume of the dehumidification equipment in such a way that it will not interfere with the dehumidification equipment's capacity to control the space as described herein.

C. Heating Equipment:

1. Design: Only electric or indirect gas fired auxiliary heaters shall be used. No direct fired space heaters will be allowed during the blasting, coating or curing phases.

2. Performance Criteria:

   a. Equipped with controls that automatically turn the heater off if the airflow is interrupted or the internal temperature of the heater exceeds its design temperature or that of the supply duct.

   b. Air heaters or refrigeration equipment are not acceptable as a substitute for dehumidification.

2.8 ELECTRICAL POWER AND GENERATOR REQUIREMENTS

A. If the operating equipment is to be electrically powered by connection to the local electrical utility, the CONTRACTOR shall be responsible for all utility arrangements. The CONTRACTOR's attention is directed to the General Requirement Sections regarding temporary utilities for construction purposes.

B. If portable electric generators are used for operating equipment, including moisture control equipment, they shall include acoustic attenuation shrouds and be strategically located on site to minimize noise impact to nearby residents.

C. Noise Limitations:

1. The CONTRACTOR's attention is directed to the General Conditions and Supplementary General Conditions, regarding noise limitations.

2.9 ACCESS MANWAY GASKETS AND HARDWARE

A. Replace gaskets and hardware for access manways into reservoir which are opened during construction.

B. Furnish and install galvanized steel bolts, nuts and washers. Regular hexagon-head bolts per ASTM A307, Grade A.

C. Gaskets shall be full-face gaskets which are NSF-61 approved, molded fluoroelastomer, 1/8-inch thickness, Garlock Stress Saver XP or approved equal.

D. Contractor to field verify all dimensions before ordering materials.

PART 3 EXECUTION

3.1 INSPECTION

A. The CONTRACTOR, ENGINEER and local painting manufacturer representative shall jointly inspect surfaces to receive finishes.

1. Examine surfaces scheduled to be finished prior to commencement of Work, and report conditions capable of affecting proper application.

2. At the ENGINEER's direction, correct defects prior to application of coatings systems specified herein.

3. Painting over the work of other trades does not constitute acceptance of previous work and surfaces by ENGINEER.

3.2 PROTECTION

A. Cover miscellaneous tank openings, except as required for ventilation, to avoid accumulation of cleaning residue and paint material in overflows, drains, inlet and outlet piping.

B. Exterior Tank:

1. Cover tank vents without sealing tight to prevent contamination of tank interior.
2. Maintain ventilation of tank interior.

C. Protect equipment from abrasion and paint damage.

D. Cleaning and painting tank exterior after tank is filled is not permitted.

3.3 POST-FABRICATION AND ERECTION CUT-OUTS

A. One cut-out of the reservoir shell will be allowed for the temporary purpose of moving equipment into, out of, or off of the steel tank structure.

1. Cut-outs shall be accommodated by cutting out and re-welding an entire full-height fabricated steel shell panel section at the shell pattern layout seams.

2. Special cut-outs within a fabricated steel panel will not be allowed.

B. The intent of this specification is to preserve the aesthetic appearance of existing symmetrical and uniform fabricated panel layouts and weld seams. It is not the intent of this specification to restrict the CONTRACTOR installing or removing equipment into or from the structure.

C. For this project, the cut-out shall be located field located by ENGINEER and OWNER.

3.4 SURFACE PREPARATION

A. General:

1. Unless specified otherwise herein, all surface preparation, coating and paint application shall conform to applicable standards:

a. The Society for Protective Coatings (SSPC).

1) All painting work shall be conducted in accordance with SSPC Painting Manual, Volume 1 - Good Painting Practices.

b. American Water Works Association (AWWA).

c. Manufacturer's printed instruction.

2. Skilled Craftsmen:

a. All work shall be performed by skilled craftsmen qualified to perform the required work in a manner comparable with the best standards of practice.

b. Continuity of personnel shall be maintained and transfers of key personnel shall be coordinated with the ENGINEER.

3. Supervisor:

a. Provide a supervisor to be at the Site during surface preparation, paint coatings application and disinfection operations.

b. Supervisor shall have the authority to sign change orders, coordinate work and make other decisions pertaining to the fulfillment of the work requirements.

4. Rolling Scaffolds:

a. Blast cleaning from rolling scaffolds shall only be performed within the confines of the interior perimeter of scaffolds.

b. Reaching beyond the limits of the perimeter will be allowed only if the blast nozzle is maintained in a position which will produce a profile acceptable to ENGINEER.

5. Slag and weld metal accumulation and spatters not previously removed by others including the fabricator, erector or installer shall be removed by chipping and grinding. All sharp edges shall be peened, ground or otherwise blunted.

6. Evaluation:

a. Surface evaluated before and after preparation will be based upon comparison with:

1) SSPC-VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning.

2) SSPC-VIS 2, Standard Method of Evaluating Degree of Rusting on Painted Steel Surfaces.

3) SSPC-VIS 3, Guide and Reference Photographs for Steel Surfaces Prepared by Power- and Hand-Tool Cleaning.

4) SSPC-VIS 4, Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting.

5) SSPC-VIS 5, Guide and Reference Photographs for Steel Surfaces Prepared by Wet Abrasive Blast Cleaning.

6) ASTM D610, Standard Method of Evaluating Degree of Rusting on Painted Steel Surfaces.

7) ASTM D2200, Standard Practice for Use of Pictorial Surface Preparation Standards and Guides for Painting Steel Surfaces.

b. Anchor Profile: Anchor profile for prepared surfaces shall be measured by using a non-destructive testing instrument such as a Keane-Tator Surface Profile Comparator or Testex Press-O-Film System to be provided by the CONTRACTOR.

7. The latest revision of the following surface preparation specifications of The Society for Protective Coatings (SSPC) shall form a part of this Specification:

a. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, dirt, soil, salts and contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.

b. Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mill scale, and loose paint to degree specified, by hand chipping, scraping, sanding, and wire brushing.

c. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mill scale, and loose paint to degree specified, by power tool chipping, descaling, sanding, wire brushing or wire impact tools, and grinding.

d. White Metal Blast Cleaning (SSPC-SP5): Removal of all visible rust, mill scale, paint and foreign matter by blast cleaning by wheel or nozzle (dry or wet) using sand, grit, or shot.

e. Commercial Blast Cleaning (SSPC-SP6): Removal of all visible rust, mill scale, paint and foreign matter by blast cleaning. Staining is permitted on no more than 33% of each 9 in^2 area of the cleaned surface.

f. Brush-off Blast Cleaning (SSPC-SP7): Blast cleaning of all except tightly adhering residues of mill scale, rust, and coatings, while uniformly roughening the surface.

g. Pickling (SSPC-SP8): Complete removal of rust and mill scale by acid pickling, duplex pickling, or electrolytic pickling.

h. Near-White Blast Cleaning (SSPC-SP10): Removal of all visible rust, mill scale, paint and foreign matter by blast cleaning. Staining is permitted on no more than 5% of each 9 in^2 area of the cleaned surface.

i. Power Tool Cleaning to Bare Metal (SSPC-SP11): Complete removal of all rust, scale, and paint by power tools, with resultant minimum surface profile of 25 µm (1 mil).

j. Industrial Blast Cleaning (SSPC-SP14): Between SP 7 (brush-off blast cleaning) and SP 6 (commercial blast cleaning). The intent is to remove as much coating as possible, but tightly adherent rust, mill scale, and coating can remain on 10% of each 9 in^2 area of the cleaned surface.

k. Commercial Grade Power Tool Cleaning (SSPC-SP15): Between SP 3 (power tool cleaning) and SP 11 (power tool cleaning to bare metal). Removes all rust and paint but allows for random staining on up to 33% of each 9 in^2 area of the cleaned surface; requires a minimum surface profile of 25 µm (1 mil).

l. Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-ferrous Metals (SSPC-SP16): Requirements for removing loose contaminants and coating from coated and uncoated galvanized steel, stainless steels, and non-ferrous metals. Requires a minimum 19 µm (0.75 mil) surface profile on bare metal substrate.

m. Waterjet Cleaning of Metals – Clean to Bare Substrate (SP WJ-1): Cleanest waterjetting level, requires the cleaned metal to be free of all visible oil, grease, dirt, rust and other corrosion products, previous coatings, mill scale, and foreign matter.

n. Waterjet Cleaning of Metals – Very Thorough Cleaning (SP WJ-2): Requires the cleaned metal surface to be free of all visible oil, grease, dirt, rust and other corrosion products, except for randomly dispersed stains of rust and other corrosion products, tightly adherent thin coatings, and other tightly adherent foreign matter previous coatings, mill scale, and foreign matter over no more than 5% of each 9 in^2 area of the cleaned surface.

o. Waterjet Cleaning of Metals – Thorough Cleaning (SP WJ-3): Requires removal of all visible contaminants as in WJ-2 above. Randomly dispersed staining as described in WJ-2 is limited to no more than 33% of each 9 in^2 area of the cleaned surface.

p. Waterjet Cleaning of Metals – Light Cleaning (SP WJ-4): Requires removal of all visible oil, grease, dirt, dust, loose mill scale, loose rust and other corrosion products, and loose coating. Any residual material shall be tightly adhered to the metal substrate.

8. All welds, when required, shall be neutralized with a suitable chemical compatible with the specified coating or paint materials.

9. Keep the area of Work in a clean condition.

   a. Do not permit blasting materials to accumulate so as to constitute a nuisance or hazard to the prosecution of Work or the operation of the existing facilities.

b. Spent abrasives and other debris shall be removed at the CONTRACTOR's expense as directed by the ENGINEER.

c. If waste is determined to be hazardous, disposal by the CONTRACTOR shall meet requirements of all regulatory agencies for handling and disposing of such wastes as noted elsewhere in this Section.

10. Remove residue from surface preparation before paint application is begun.

a. Blast-cleaned surfaces shall be cleaned prior to application of specified coatings or paints through a combination of blowing with clean dry air, brushing/brooming and/or vacuuming as directed by the ENGINEER.

b. Air hoses for blowing shall be at least ½-inch in diameter and shall be equipped with a shut-off device.

11. Any surfaces not coated/painted the same day they are prepared to receive the specified paint systems shall be re-prepared prior to coating/painting, unless the ENGINEER-approved moisture control equipment is used by the CONTRACTOR to maintain conditions that allow extended blasting schedules prior to application of prime coats.

B. Surface Preparation, Interior Surfaces

1. For new reservoir construction:

a. Prepare all interior surfaces of the reservoir and associated interior structures according to SSPC-SP 5, White Metal Blast Cleaning.

b. Anchor profile shall be measured as described elsewhere in this Section.

c. Following blast cleaning and prior to painting, the following additional operations shall be performed:

1) Material Removal: Remove spent abrasives and existing coating waste material from all blasted surfaces. This shall be accomplished by blowing off all blasted surfaces with clean, dry air and vacuum cleaning or blooming/sweeping of all waste material.

2) Remove or cause to be removed all traces of rust bloom or deposits of oil, grease, or other contaminants which become visible prior to application of the prime coat.

a) Humidity and Temperature Control

3) General: Humidity and temperature control, when specified and required elsewhere in this Section for interior spaces, shall be provided using appropriate specialized equipment.

a) Dehumidification: Dehumidification equipment shall be used to control the environment in the space on

a continuous basis 24 hours a day during blast cleaning, coating and coating curing unless otherwise approved by ENGINEER.

4) Heating Equipment: Auxiliary heaters or chillers may be necessary to maintain the surface temperature at a level acceptable to the coating manufacturer's application parameters.

a) Heaters and coolers shall be installed in the process air supply duct between the dehumidifier and the space as close to the space as possible.

b) The space to be controlled shall be sealed off as well as possible allowing air to escape at the bottom of the space away from the point where the dehumidified air is being introduced.

c) Maintain a slight positive pressure in the space unless the dust from the blasting operation is hazardous.

d) Do not recirculate the air from the space or from filtration equipment back through the dehumidifier when coating or solvent vapors are present.

2. For existing reservoir:

a. All exterior surfaces of the reservoir and associated exterior structures shall be prepared with a 50% bleach solution to kill mildew or other biological growth prior to waterjet cleaning.

b. Waterjet Cleaning:

1) After applying bleach solution, all exterior surfaces of the reservoir and associated exterior structures shall be waterjet cleaned with a 5% TSP solution.

2) Waterjet cleaning equipment shall comply with requirements specified elsewhere in this Section.

3) Prepare all exterior metal surfaces according to SP WJ-4, Waterjet Cleaning of Metals, Light Cleaning. Remove all but the most tightly adherent paint per SSPC surface preparation specification. Acceptable surface preparation by waterjet cleaning shall be determined by hand-tool cleaning of adhered topcoat paint. Topcoat paint which cannot be removed by hand-tool cleaning shall be considered acceptable to receive the new paint systems specified herein.

c. Following waterjet cleaning and prior to spot surface preparation and painting, the following additional operations shall be performed, as required:

1) Pitting Inspection and Repairs:

a) The ENGINEER and CONTRACTOR will perform an inspection of the blasted substrate metal for identification of areas with significant pitting of the substrate metal and any surface deficiencies.

b) Pitting of the substrate metal to a depth greater than 1/8-inch shall be ground out with a suitable grinding tool and filled with weld filler materials so that the deposited weld filler material forms a convex surface over the base metal. This convex surface shall then be ground flush to the base metal prior to any additional surface preparation and subsequent application to application of the prime coat. Surface deficiencies identified shall be repaired to the satisfaction of the ENGINEER.

d. Following waterjet cleaning and prior to painting, the following surface preparation of all locations of compromised coating shall be performed:

1) Spot Surface Preparation: All locations where the existing coating system has failed and there is visible rust or other surface contamination, power-tool cleaning to bare metal (SSPC SP-11) shall be performed.

2) Care shall be taken to feather the surface preparation into the existing coating to remain in order to create a surface that will easily accept the new coating system primer.

3) Follow all manufacturer requirements regarding minimum surface profile of the steel to receive the new spot primer.

C. Surface Preparation, Exterior Surfaces

1. For new reservoir construction:

a. Prepare all exterior surfaces of the reservoir and associated exterior structures according to SSPC-SP 10, Near-White Metal Blast.

2. For existing reservoir:

a. All exterior surfaces of the reservoir and associated exterior structures shall be prepared with a 50% bleach solution to kill mildew or other biological growth prior to waterjet cleaning.

b. Waterjet Cleaning:

1) After applying bleach solution, all exterior surfaces of the reservoir and associated exterior structures shall be waterjet cleaned with a 5% TSP solution.

2) Waterjet cleaning equipment shall comply with requirements specified elsewhere in this Section.

3) Prepare all exterior metal surfaces according to SP WJ-4, Waterjet Cleaning of Metals, Light Cleaning. Remove all but the most tightly adherent paint per SSPC surface preparation specification. Acceptable surface preparation by waterjet cleaning shall be determined by hand-tool cleaning of adhered topcoat paint. Topcoat paint which cannot be removed by hand-tool cleaning shall be considered acceptable to receive the new paint systems specified herein.

c. Following waterjet cleaning and prior to spot surface preparation and painting, the following additional operations shall be performed, as required:

1) Pitting Inspection and Repairs:

a) The ENGINEER and CONTRACTOR will perform an inspection of the blasted substrate metal for identification of areas with significant pitting of the substrate metal and any surface deficiencies.

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d. Following waterjet cleaning and prior to painting, the following surface preparation of all locations of compromised coating shall be performed:

1) Spot Surface Preparation: All locations where the existing coating system has failed and there is visible rust or other surface contamination, power-tool cleaning to bare metal (SSPC SP-11) shall be performed.

2) Care shall be taken to feather the surface preparation into the existing coating to remain in order to create a surface that will easily accept the new coating system primer.

3) Follow all manufacturer requirements regarding minimum surface profile of the steel to receive the new spot primer.

3.5 APPLICATION

A. General:

1. According to SSPC Paint Application Specification PA 1 - Shop, Field and Maintenance Painting, latest revision.

2. Printed literature of the manufacturer of the coating and paint materials.

3. As further specified within this Section.

B. Ventilation: Provide for adequately ventilated enclosed rooms and spaces during painting and curing periods.

C. Thickness:

1. Apply coatings in strict conformance with the manufacturer's application instructions.

2. Apply each coat at the rate specified by the manufacturer to achieve the dry mil thickness specified.

3. If material must be diluted for application by spray gun, build up more coating to achieve the same thickness as undiluted material.

4. Correct any apparent deficiencies of film thickness by the application of an additional coat.

D. Thinning:

1. Do not thin pain unless approved by the ENGINEER.

2. Only use thinner recommended by paint manufacturer which has been determined to be compatible with specified coating system.

3. Thin paint in accordance with the manufacturer's directions.

E. Application:

1. Each application of coatings shall be applied evenly, free of brush marks, sags, runs and no evidence of poor workmanship.

2. Care shall be exercised to avoid lapping on glass or hardware.

3. Coatings shall be sharply cut to lines.

4. Finished surfaces shall be free from defects or blemishes.

F. Interior Coatings: By airless spray application, except where back rolling or striping is performed.

G. Exterior Paint Application: By spray or roller.

1. Brushing may be used to repair paint in areas of steel modifications.

H. Brush Coats:

1. All welds, laps, edges, inside angles, and irregular surfaces shall receive a brush coat of the specified product prior to application of each complete coat.

2. Paint may be applied as a spray stripe coat and back brushed by hand.

3. Coatings shall be brushed in multiple directions to insure penetration and coverage, as directed by the ENGINEER.

I. Non-Skid Surfaces: Applied after the full prime coat has cured.

1. Where shown on the Drawings or specified elsewhere in this Section, a non-skid surface shall be applied to a portion of the reservoir roof surface.

2. Application:

a. Broadcast over a wet coat of the finish top coat specified herein.

b. Following curing of coating/sand mixture, non-skid surface area shall be top coated with the same finish coating.

3. Locations:

a. As shown on the Drawings.

J. At conclusion of each day's cleaning and coating operations, a 6-inch wide strip of cleaned substrate shall remain uncoated to facilitate locating the point of origin for each successive day's cleaning operations.

K. Curing Time:

1. Do not apply the next coat of paint until each coat is dry.

2. Test non-metallic surfaces with a moisture meter.

3. The manufacturer's recommended curing time shall mean an interval under normal conditions that is to be increased to allow for adverse weather or curing conditions.

4. Paint manufacturer's representative shall verify by cure testing the complete cure of coatings systems used for immersion service.

L. Attachments, Accessories and Appurtenance: All attachments, accessories, and appurtenances shall be prepared and coated in the same manner as specified for

adjacent structures, unless otherwise specified elsewhere in this Section or other sections of the Specifications.

M. Protection of Coated Surfaces:

1. Protective coverings or drop cloths shall be used to protect floors, fixtures, equipment, prepared surface and applied coatings.

2. Personnel entering the reservoir or walking on the exterior roof of the reservoir shall take precautions to prevent damage or contamination of coated surfaces.

3. Care shall be exercised to prevent coatings from being spattered onto surfaces which are not to be coated.

4. Surfaces from which such material cannot be removed satisfactorily shall be repainted as required to produce a finish satisfactory to the ENGINEER.

N. Atmospheric Conditions: No coatings shall be applied under the following limitations:

1. Temperature: If temperatures are anticipated to be as noted below within eight hours after application of the coating.

   a. Epoxy Coatings: Surface to be coated is below 55 degrees F. Exceptions may be approved by ENGINEER with concurrence from manufacturer if material is “low temperature” type.

   b. Inorganic Zinc or Urethane Finishes: Surface to be coated is below 40 degrees F.

   c. When the temperature is less than 5 degrees F above the dew point.

      1) The dew point shall be measured by use of an instrument such as a sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychometric Tables or other instrument acceptable to the ENGINEER.

   d. When the temperature of the surface to be coated is above 125 degrees F for all coating types.

2. Surfaces: When the surfaces to be coated are wet or damp or there is the presence of rain, snow, fog or mist.

3. If any of the above adverse conditions are present, the coating or paint application shall be postponed until conditions are favorable. The day's coating or paint application shall be completed in time to permit the film sufficient drying time prior to the onset of adverse atmospheric conditions.

3.6 SHOP QUALITY CONTROL

A. Quality assurance procedures and practices shall be used to monitor all phases of surface preparation, application and inspection of all shop coating performed as part of this project. A NACE Certified Level 2 Coating Inspector shall oversee all shop coating performed and provide the ENGINEER with written reports on a form approved by the ENGINEER prior to work being performed.

B. For new reservoir construction, the application of permanent shop-applied primers will be allowed for exterior surfaces of the reservoir provided that a NACE Certified Level 2 Coating Inspector observes the procedures and provides written reports certifying all work to be in conformance with these Specifications.

C. Unless approved by the ENGINEER at the request of the CONTRACTOR, the application of permanent shop-applied primers will not be allowed for interior surfaces of the reservoir.

D. Procedures or practices not specifically defined herein may be used provided they meet recognized and acceptable professional standards and are approved by the ENGINEER.

E. All materials furnished and all work performed shall be subject to inspection by the ENGINEER. The CONTRACTOR shall be held strictly to the true intent of the Specifications in regard to quality of materials, workmanship, and diligent execution of the work.

F. The following procedures shall be followed by the CONTRACTOR in the handling of shop-primed steel:

1. Curing: Upon completion of blasting and priming operations, primer on fabricated steel shall be cured sufficiently to minimize damage during handling.

2. Separation of Steel: When fabricated steel is transported, spacers and other protection shall be used to separate members to eliminate primer from being pulled off during unloading operations. If wood spacers are used, no splinters or wood particles shall remain in primed surfaces after separation.

3. Cover of Steel during Transit: Shop-primed fabricated steel shall be covered 100% to prevent deposition of road salts, fuel residue and other contaminants which may be present along the route of shipment to jobsite.

4. Load Binders: Loaded steel must be bound with padded chains or ribbon binders to minimize damage to coatings during shipment.

5. Handling: Care shall be used during loading, unloading, storage and erection operations to minimize damage to primed steel. Sliding of steel across another

member shall not be permitted, except for fitting members into position during assembly.

6. Storage: Primed fabricated steel at jobsite shall not be placed on ground or on top of other steel work unless ground or steel work is covered with an approved covering. Approved spacers shall be used to elevate steel above ground level or other steel members.

3.7 FIELD QUALITY CONTROL

A. Quality assurance procedures and practices shall be used to monitor all phases of surface preparation, application and inspection throughout the duration of the Project. Procedures or practices not specifically defined herein may be used provided they meet recognized and acceptable professional standards and are approved by the ENGINEER.

B. All materials furnished and all work performed shall be subject to inspection by the ENGINEER. The CONTRACTOR shall be held strictly to the true intent of the Specifications in regard to quality of materials, workmanship, and diligent execution of the work.

C. Field Inspection: CONTRACTOR shall notify ENGINEER when painting work is to be in progress in time for ENGINEER to check atmospheric conditions, surface preparation, mixing and thinning procedures, materials and thicknesses with wet film thickness gauge at frequent intervals and varied locations during the course of painting work.

D. The ENGINEER will make, or arrange to have made by others, such tests as may be deemed necessary to assure the Work is being accomplished in accordance with the requirements of the specifications.

1. Unless otherwise specified, the cost of such testing will be borne by the OWNER.

2. In the event such tests reveal non-compliance, the CONTRACTOR shall bear the cost of such corrective measures deemed necessary by the ENGINEER, as well as the cost of retesting.

3. It is understood and agreed that the performance of tests by the ENGINEER shall not constitute an acceptance of any portion of the Work, nor relieve the CONTRACTOR from compliance with the project requirements.

E. Testing Instruments:

1. Provide all inspection devices in good working condition.

2. Inspection devices shall be operated by, or in the presence of the ENGINEER with the location and the frequency basis of testing as determined by the ENGINEER.

3. Provide all instruments required for testing atmospheric conditions and shall, during painting/coating operations, perform all measurements in the presence of the ENGINEER.

    a. As a minimum, measure and record temperature, relative humidity and dew point daily prior to beginning any painting/coating operations and again at mid-day.

    b. Measurement records shall be maintained by the CONTRACTOR on forms approved by the ENGINEER.

4. Provide all instruments required for detection of holidays and measurement of dry-film thickness of coatings and paints.

    a. Holiday detectors and dry film thickness gauges shall be available at all times until final acceptance of painting/coating application.

    b. Inspection devices shall be operated in accordance with the manufacturer's instructions.

    c. Holiday Detectors: Acceptable devices for ferrous metal surfaces include, but are not limited to, Tinker & Rasor Models AP and AP/W holiday detectors or other units approved by the ENGINEER.

    d. Dry Film Thickness Gauges: DeFelsko Positest (Type 1), DeFelsko Positector 6000 (Type 2), or other units approved by the ENGINEER.

5. Provide U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test the accuracy of thickness gauges.

6. The ENGINEER is not precluded from furnishing its own inspection devices and rendering decisions based solely upon its tests.

F. Thickness of Coatings:

1. Thickness of coatings and paint shall be checked with a non-destructive, magnetic-type thickness gauge.

2. Destructive Testing: An instrument such as a Tooke Gage shall be used if a destructive tester is deemed necessary.

3. The coating integrity of all coated surfaces shall be tested with an approved inspection device.

4. All pinholes shall be marked, repaired in accordance with the manufacturer's printed recommendations, and retested.

5. No pinholes or other irregularities will be permitted in the final coating.

G. Wet Film Thickness: Use wet film thickness gauges to ensure proper application rates to prevent over-thick coatings and curing difficulties.

H. Additional Coats: Provide additional coats of paint at no additional cost to the OWNER when mil thicknesses specified have not been obtained as determined by either dry or wet film thickness testing specified herein.

I. Painting Equipment:

1. Coating and painting equipment shall be designed for the proper application of the materials specified and shall be maintained in first class working condition.

2. Compressors shall have suitable traps and filters to remove water and oils from the air.

3. Blotter tests shall be performed at each start-up period and as deemed necessary by the ENGINEER.

4. Equipment shall be subject to approval of the ENGINEER.

J. Moisture Control Equipment: Employ to maintain conditions within the reservoir interior which allow extended blasting and painting schedules.

K. Painting/Coating Manufacturer’s Representative:

1. Services of the paint/coating manufacturer's representative shall be provided at no additional expense to the OWNER.

2. Reporting from the paint manufacturer's representative shall not preclude the ENGINEER from making independent assessments of the quality of Work. The ENGINEER will make the final decision as to the acceptability of the paint/coating systems.

3. Responsibilities:

a. Make periodic site visits throughout the course of the surface preparation and the painting/coating application.

b. Schedule all site visits with the ENGINEER.

c. Minimum Site Visits:

1) Inspect typical shop and field steel preparation prior to primer applications.

2) Inspect finished primer applications prior to application of intermediate coats.

3) Inspect each intermediate coat prior to application of subsequent finish coats.

4) Inspect final coats and report to the ENGINEER the representative's assessment of the paint system's suitability and acceptability for the intended service.

d. Prepare and submit written reports directly to the ENGINEER immediately following each site visit.

1) Reports shall identify the representative's observations relative to the quality of the surface preparation and painting/coating work.

2) Reports shall address any conditions observed which have the potential to adversely impact the finished painting/coating system's integrity and performance.

e. Any such findings shall be immediately remedied by the CONTRACTOR.

L. Damaged Factory Finishes: If directed by the ENGINEER, refinish the entire exposed surfaces of factory-finished equipment that is chipped, scratched or otherwise damaged in shipment or installation

3.8 CLEANUP

A. Remove all staging, scaffolding, ladders and containers shall be removed from the Site.

B. Remove temporary heating and ventilating facilities.

C. Coating or paint spots upon adjacent surfaces shall be removed and the entire Site cleaned.

D. All damage to surfaces resulting from the work of this Section shall be cleaned, repaired or refinished to the complete satisfaction of the ENGINEER at no cost to the OWNER.

E. Allow a minimum of seven days at 70°F curing after application of the final coat to the tank interior before flushing, sterilizing or filling with water.

1. Utilize a recording or high/low-indicating thermometer and paint manufacturer's reference charts to determine actual cure time of products.

2. Prior to disinfection, demonstrate complete curing to ENGINEER and paint manufacturer's representative.

3. Use forced ventilation during approved work days and hours identified elsewhere in this Section to assist curing.

F. Disinfect the tank interior according to Section 33 13 13 Water Storage Tank Disinfection.

3.9 COLLECTION, MONITORING AND DISPOSAL OF REGULATED WASTES

A. Samples of the exterior coating were field tested for lead and no lead was detected. The exterior coating appears to be well adhered to the substrates and was applied in the 1970's. Although it is believed there is little to no lead present in either the interior or exterior coating, as a precaution, all interior and exterior waste generated from surface preparation work shall be tested by the CONTRACTOR for lead content. The CONTRACTOR shall, prior to project closeout and as a condition of final payment, furnish the ENGINEER with bound project records which document that the collection, testing, containment and disposal of any regulated wastes generated by the CONTRACTOR on this project were executed in compliance with all applicable Federal, State and local laws and regulations regarding worker protection, health, and safety. Any costs associated with these requirements shall be included in the CONTRACTORs bid and no separate payment will be made.

B. Unless otherwise indicated on the Plans or in the Specifications, all abrasive blasting material and byproducts, paints, solvents and containers and any other discarded materials or equipment shall remain the property of the CONTRACTOR and shall be disposed of in a manner compliant with applicable Federal, State and local laws and regulations governing disposal of all wastes generated by the CONTRACTOR in the prosecution of this work.

END OF SECTION

SECTION 11 05 00

COMMON WORK RESULTS FOR EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Provide all tools, supplies, materials, equipment and all labor necessary for the furnishing, construction, installation, testing and operation of equipment and appurtenant work, complete and operable, all in accordance with the requirements of the Contract Documents.

B. The provisions of this Section shall apply to all equipment specified and where referred to, except where otherwise specified or shown.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. All equipment, products and their installation shall be in accordance with the following standards, as applicable and as specified in each section of these specifications:

1. American Society for Testing and Materials (ASTM)
2. American Public Health Association (APHA)
3. American National Standards Institute (ANSI)
4. American Society of Mechanical Engineers (ASME)
5. American Water Works Association (AWWA)
6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
7. American Welding Society (AWS)
8. National Fire Protection Association (NFPA)
9. Federal Specifications (FS)
10. National Electrical Manufacturers Association (NEMA)
11. Manufacturer’s published recommendations and specifications
12. Oregon Occupational Safety and Health Division (OR-OSHA)

B. The following standards have been referred to in this Section of the specifications.

1. ASTM International:

a. ASTM A48 - Specification for Gray Iron Castings.

b. ASTM A108 - Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.

2. American National Standards Institute (ANSI):

a. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.

b. ANSI B16.5 - Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy and Other Special Alloys.

c. ANSI B46.1 - Surface Texture.

d. ANSI S12.6 - Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors.

3. American Society Mechanical Engineers (ASME):

a. ANSI/ASME B1.20.1 - General Purpose Pipe Threads (Inch).
b. ANSI/ASME B31.1 - Power Piping.

4. American Water Works Association (AWWA):

a. AWWA C206 - Field Welding of Steel Water Pipe.

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Furnish complete shop drawings for all equipment specified in the various sections, together with all piping, valves and controls for review by the ENGINEER.

2. Include calculations showing equipment anchorage forces and the capacities of the anchorage elements where required.

C. Special Tools:

1. Supply one complete set of special tools where necessary for the assembly, adjustment and dismantling of the equipment.

2. Tools shall be suitable for professional work and manufactured by a recognized supplier of professional tools such as Snap On, Crescent, Stanley, or equal.

D. Spare Parts:

1. Obtain and submit from the manufacturer a list of suggested spare parts for each piece of equipment.

2. Furnish the name, address and telephone number of the nearest distributor for each piece of equipment.

3. Spare parts shall be supplied when indicated in the appropriate equipment specification sections.

E. Torsional and Lateral Vibration Analysis:

1. Where required by the individual equipment sections, provide a torsional and lateral vibration analysis of the equipment, in accordance with Section 01 33 00, Submittals.

2. Equipment shall be designed and constructed such that the natural frequency of the drive train is avoided by a minimum of 25 percent throughout the entire operating range.

3. Analysis shall be performed by a specialist experienced in this type of work and approved by the Engineer.

a. The specialist, or their assigned representative who shall similarly be experienced in this type of work and who shall be approved by the Engineer, shall visit the Site during startup and testing of the equipment to analyze and measure the amount of equipment vibration, certify that the operating frequency avoids the natural frequency by 25 percent, and make a written recommendation for keeping the vibration at a safe limit.

1.4 QUALITY ASSURANCE

A. Demonstrate all equipment meets the specified performance requirements. Provide the services of an experienced, competent and authorized service representative of the manufacturer of each item of major equipment, who shall visit the Site to perform the following tasks:

1. Assist the Contractor in the installation of the equipment.

2. Inspect, check, adjust if necessary and approve the equipment installation.

3. Start-up and field-test the equipment for proper operation, efficiency and capacity.

4. Perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the ENGINEER.

5. Instruct the OWNER's personnel in the operation and maintenance of the equipment. Instruction shall include step-by-step trouble shooting procedures with all necessary test equipment.

B. The costs of all inspection, startup, testing, adjustment and instruction work performed by said factory-trained representatives shall be borne by the Contractor. When available, the Owner's operating personnel will provide assistance in the field testing.

C. Tolerances and clearances shall be as shown on the shop drawings and shall be closely adhered to. Machine work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts.

D. The type of finish shall be the most suitable for the application and shall be in accordance with ANSI B46.1.

E. Unless otherwise noted, all equipment furnished shall have a record from the same manufacturer of at least 3 years successful, trouble-free operation in similar applications.

1.5 DELIVERY, HANDLING AND STORAGE

A. All equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling and storage.

B. Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number shown or specified for the particular item.

C. All equipment shall be protected from exposure to corrosion and shall be kept thoroughly dry at all times.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Hearing Protection:

1. At each high noise level location, where equipment produces noise exceeding 85 dBA at 3 feet or exceeding OSHA noise level requirements for operator safety, supply two pairs of high attenuation hearing protectors.

2. Ear protectors shall meet the requirements of ANSI S12.6 and shall produce a noise level reduction of 25 dBA at a frequency of 500 Hz.

3. Hearing protectors shall have fluid filled ear cushions and an adjustable, padded headband.

4. Protectors shall be stored in a weatherproof, labeled, steel cabinet, furnished by the CONTRACTOR and mounted in an approved location near the noise producing equipment.

B. Welding:

1. Unless otherwise specified or shown, all welding shall be by the metal arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS.

2. Qualification of welders shall be in accordance with the AWS Standards governing same.

C. Protective Coatings:

1. All equipment shall be painted or coated in accordance with Section 09 90 00, Painting and Coating, unless otherwise indicated.

2. Non-ferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil.

3. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly and shipping.

D. All equipment subject to vibration shall be provided with restrained spring type vibration isolators or pads per manufacturer's written recommendations.

E. Shop fabrication shall be performed in accordance with the Specifications and the Engineer-approved shop drawings.

2.2 EQUIPMENT SUPPORTS AND FOUNDATIONS

A. Design Loads:

1. All equipment supports, anchors and restraint shall be adequately designed for static, dynamic, wind and seismic loads.

2. The design horizontal seismic force shall be the greater of that noted in the general structural notes or as required by the governing building code (10 percent of gravity minimum).

B. Equipment foundations shall be as per manufacturer's written recommendations.

C. All equipment shall be mounted as shown on the manufacturer's standard details, unless otherwise shown or specified.

2.3 PIPE HANGERS, SUPPORTS AND GUIDES

A. All pipe connections to equipment shall be supported, anchored and guided to avoid stresses and loads on equipment flanges and equipment.

2.4 FLANGES AND PIPE THREADS

A. All flanges on equipment and appurtenances provided under this Section shall conform to ANSI B16.1, Class 125 or B16.5, Class 150, unless otherwise shown.

B. All pipe threads shall be in accordance with ANSI/ASME B1.20.1 and with requirements of Section 40 05 13, Common Work Results for Process Piping.

2.5 COUPLINGS

A. Flexible couplings shall be provided between the driver and the driven equipment to accommodate slight angular misalignment, parallel misalignment, end float and to cushion shock loads. Where required for vertical shafts, three-piece spacer couplings or universal type couplings for extended shafts shall be installed.

B. The Contractor shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.

C. Taper-lock bushings may be used to provide for easy installation and removal on shafts of various diameters.

D. Where universal type couplings are shown, they shall be equipped with grease fittings.

2.6 BEARINGS

A. Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association (AFBMA).

B. All field-lubricated type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.

C. All lubricated-for-life bearings shall be factory-lubricated with the manufacturer’s recommended grease to insure maximum bearing life and best performance.

D. Except where otherwise specified or shown, all bearings shall have a minimum B-10 life expectancy of 5 years or 20,000 hours, whichever occurs first.

E. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as specified or shown, or as recommended in the published standards of the manufacturer. Split type housings may be used to facilitate installation, inspection and disassembly.

F. Sleeve type bearings shall have a Babbitt or bronze liner.

2.7 V-BELT DRIVES

A. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI, MPTA and RMA standards.

B. Unless otherwise specified, sheaves shall be machined from the finest quality gray cast iron.

C. All sheaves shall be statically balanced. In applications where vibration is a problem, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 fpm may be required to be of special materials and construction.

D. To facilitate installation and disassembly, sheaves shall be furnished complete with taper-lock or QD bushings as required.

E. Finish bored sheaves shall be furnished complete with keyseat and set screws.

F. Sliding motor bases shall be provided to adjust the tension of V-belts.

2.8 DRIVE GUARDS

A. All power transmission, prime movers, machines, shaft extensions and moving machine parts shall be guarded to conform with the OSHA Safety and Health Standards (29CFR1910) requirements.

B. Guards shall be constructed of minimum 10-gauge expanded, flattened steel with smooth edges and corners, galvanized after fabrication and securely fastened.

C. Where required for lubrication or maintenance, guards shall have hinged and latched access doors.

2.9 FLEXIBLE CONNECTORS

A. Flexible connectors shall be installed in all piping connections to engines, blowers, compressors and other vibrating equipment.

2.10 GASKETS AND PACKINGS

A. Gaskets shall be in accordance with the requirements of Section 40 05 13, Common Work Results for Process Piping.

B. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron type “V” packing shall be Garlock No. 432, John Crane “Everseal” or equal.

C. Packing around rotating shafts (other than valve stems) shall be “O” rings, stuffing boxes or mechanical seals, as recommended by the manufacturer and approved by the ENGINEER.

2.11 NAMEPLATES

A. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location.

B. Nameplates shall contain the manufacturer’s name, model, serial number, size, characteristics and appropriate data describing the machine performance ratings.

PART 3 EXECUTION

3.1 WELDING

A. In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions.

B. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag and burrs left by attachments shall be removed.

C. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions.

D. All sharp corners of material to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

3.2 COUPLINGS

A. The Contractor shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.

B. Installation shall be per equipment manufacturer’s printed recommendations.

3.3 PACKAGED EQUIPMENT

A. When any system is furnished as pre-packaged equipment, the Contractor shall coordinate all necessary space and structural requirements, clearances, utility connections, signals and outputs with his subcontractors.

B. If the packaged system has any additional features other than specified, the Contractor shall coordinate such features and furnish all material and labor necessary for a complete installation, as required by the manufacturer, at no additional cost to the Owner.

END OF SECTION

SECTION 11 81 29

FACILITY FALL PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the work to furnish and install fall prevention systems at each fixed ladder as shown on the Drawings and as required to meet all safety and occupational code requirements.

B. The requirements of the Drawings and all other sections and provisions of the specifications are applicable to the work to be performed under this Section.

C. Section includes:

1. Flexible cable ladder safety systems.

D. Related Requirements:

1. Section 33 16 13.13 - Steel Aboveground Water Utility Storage Tanks.

1.2 REFERENCE STANDARDS

A. American National Standards Institute (ANSI):

1. ANSI ASC A14.3-2008 - American Nation Standards for Ladders - Fixed - Safety Requirements.

1.3 QUALITY ASSURANCE

A. Comply with local, state and federal requirements of Occupational Safety and Health Administration (OSHA) regulations and all applicable codes and standards.

B. Install according to manufacturer’s instructions.

C. Provide all system components from a single manufacturer that will assure compatibility of all components.

PART 2 PRODUCTS

2.1 FALL PREVENTION SYSTEM

A. Fall prevention system shall be a flexible cable ladder system which includes cable, trolley, safety belt or harness, and all mounting, installation and alignment hardware

and other accessories as may be necessary to provide a complete and operational system.

B. A pivot dismount section or telescoping extension shall be provided at locations shown on the Drawings.

1. The pivot dismount section shall allow a person to step off of the ladder and onto the adjacent surface prior to unclipping from the cable.

2. Provide telescoping extensions where openings include access hatches.

C. Fall prevention cables, mounting hardware and appurtenances shall be 304 stainless steel.

D. Neoprene rubber bushing shall be provided at all ladder rung connections to prevent damage to coatings. NSF-61 approved rubber materials shall be installed at all connections inside of the potable water reservoirs.

E. Manufacturer: Fall prevention system to be Lad-Saf by DBI-SALA (Capital Safety) or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fall prevention system according to manufacturer’s instructions.

B. Provide at least two safety belts or harness assemblies and two trolley sleeves.

C. Provide a copy of fall prevention system operation instructions.

END OF SECTION

SECTION 26 00 05

ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The work consists of furnishing all labor, materials, and equipment required for electrical work shown on the drawings and as further described in these specifications.

1.2 RELATED WORK

A. Section 26 05 90 – Electrical Work, General
B. Section 26 05 26 – Grounding and Bonding Electrical Systems
C. Section 26 50 00 – Lighting

1.3 GENERAL

A. See Division 00, STANDARD GENERAL CONDITIONS and Division 001, GENERAL REQUIREMENTS, which contain information and requirements that apply to the work specified herein and are necessary for this project.

1.4 REGULATIONS AND PERMITS

A. The Contractor shall comply with all applicable codes, ordinances, and regulations, including the National Electrical Code (NEC), National Electrical Safety Codes (NESC), and the State of Washington Building Codes.

B. The Contractor shall obtain a Certificate of Electrical Inspection from the local inspecting authority and submit to the owner upon completion of the project.

1.5 SUBMITTALS AFTER AWARD OF CONTRACT

A. Submittals after award of Contract shall be made in accordance with Section 26 05 90, Electrical Work, General.

PART 2 PRODUCTS

2.1 RACEWAYS

A. All raceways shall be UL approved for the application.

B. Rigid Steel Conduit (RGS): Provide zinc-coated rigid galvanized steel conduit conforming to Federal Specification WW-C-581.

C. Polyvinyl Chloride (PVC) Coated Rigid Galvanized Steel (PVC-RGS): Provide PVC coated conduit. Rigid conduit used in the coating process shall be hot dipped galvanized inside and out in accordance with of the latest edition of Federal Specification WW-C-581-E, ANSI Standard C-80.1, and UL Standard #6. Finished conduit shall conform to the current NEMA RN-1 Standard and shall have label affixed indicating compliance with UL Standard #6.

D. Rigid PVC Conduit (PVC): Provide rigid PVC, Schedule 80, UL listed for concrete encased, direct burial underground, and exposed use. Rigid PVC conduit, including couplings, elbows and nipples, shall conform to the requirements of the latest edition of Federal Specification WW-C-1094, NEC, and UL standards.

E. Flexible Metallic Conduit (FLEX): Provide liquid tight flexible conduit, zinc-coated steel core, extruded gray PVC cover, UL approved, Sealtite type "UA" or Liquatite type "LA," or approved equivalent.

2.2 CONDUIT FITTINGS AND ACCESSORIES

A. Provide conduit fittings as follows unless otherwise noted or detailed. Catalog numbers shown are Appleton Electric Company unless otherwise noted. Other UL Listed brands of equivalent construction and function will be acceptable.

B. Nonhazardous Area Fittings

Rigid Conduit 90 Degrees Elbows	Series LMFL, ELMF
Rigid Conduit Pulling Ells	Series LB, LL, LR, FFL, MFL
Rigid Conduit Expansion Unions	UNY, UNF, Expansion Series
Sheet Steel and Fiberglass Enclosures	Watertight HUB Series
Liquidtight Insulated Connectors Throat	-STB, STN, STL, STNM Series

PVC Conduit Fittings: Provide conduit fittings as follows unless otherwise noted or detailed. Catalognumbers shown are Carlon Electrical Products. Other UL Listed brands of equivalent function and construction will be acceptable.

1. Conduit body, type T, size as required.
2. Conduit body, type LL, size as required.
3. Conduit body, type LR, size as required.
4. Conduit body, type LB, size as required.
5. Strain relief connectors and grommets, part no. H978E
6. PVC locknut, size as required.
7. Schedule 80 long line coupling, size as required.

C. PVC Coated Conduit Fittings: Provide fittings for RGS conduit as specified with minimum 40-mil PVC coating. Perma-Cote Industries or approved equal.

2.3 JUNCTION, PULL AND OUTLET BOXES

A. Provide metallic outlet boxes as follows unless otherwise noted or detailed. No nonmetallic boxes will be permitted.

1. Boxes on rigid conduit systems shall have threaded hubs and case gasketed cover, meeting F.D. W-C-586. Any type, design, form, and style will be acceptable unless otherwise specified or shown on the drawings. All exposed outdoor boxes shall be NEMA 4X, Type 316 Stainless Steel.

2. Boxes on PVC coated conduit systems shall be as specified for RGS conduit system with minimum 40-mil PVC coating. Perma-Cote Industries or approved equal.

2.4 UNDERGROUND ELECTRICAL MANHOLES AND HANDHOLES

A. Provide precast concrete manhole and handhole units of the size and configuration indicated. Concrete in the precast unit shall develop a minimum compressive strength of 4,500 psi in 28 days. Cover units and frames shall be the type as specified as to size, appearance, and mechanical strength. Covers shall seat properly to prevent rocking. Provide racks for all cables. Provide pulling irons. Manholes and handholes shall be Utility Vault Company with hinged and spring locked steel cover, similar by Brooks Products, or approved equal.

B. Provide extension sections as required to accommodate duct bank burials and to bring cover flush with finished grade.

2.5 WIRING DEVICES

A. Provide wiring devices indicated. Catalog numbers shown are Hubbell unless otherwise noted. Equivalent devices by other manufacturers may be substituted. All devices shall be submitted for approval. Provide all similar devices of same manufacturer unless indicated otherwise.

B. Switches: Provide flush switches, AC-type, rated 20 amp or higher suitable for the type load to be controlled.

1. Double-pole: 4803-GRY/20AC1GRY

C. Receptacles: Provide grounding-type receptacles as follows, all receptacles shall be Ground Fault Interrupter (GFI).

1. Ground fault interrupter:

a. Unit shall be furnished with internal, solid state, ground fault current sensing and tripping.

b. The receptacles shall include built-in "TEST" and "RESET" switches and "TRIPPED" indicator and shall be rated 20-amp, 120-volt.

c. The "GFI" receptacle shall be the "feed-thru" type and shall protect all receptacles on the same circuit.

2.6 COVER PLATES

A. Provide cover plates for all wiring devices. Where devices are installed in exposed fittings or boxes, use Appleton, Pyle-National, Crouse-Hinds, or equal, "FSK" covers. Where weatherproof devices are specified on exterior or damp locations, provide UL-Listed NEMA 3R, cast aluminum, in-use weatherproof covers. Hubbell WP26M or approved equal. Provide stainless-steel plates in all other finished areas.

2.7 CONDUCTORS AND CABLES

A. This specification covers all conductors not specifically specified in other sections. Furnish conductors and cable conforming to UL, Federal Specification J-C-30, or IPCEA as applicable. Provide new cable manufactured within 1 year prior to installation. Deliver to jobsite in original cartons bearing U.L. label.

B. 600V Power, Lighting and Control Circuits: Provide stranded copper conductors. Aluminum will not be allowed. Copper conductors shall conform to Federal Specification J-C-30. For type XHHW-2, XLP-USE, provide cross-linked polyethylene insulation conforming to IPCEA S-66-524. Color code insulation for wire sizes No. 14 AWG through No. 6 AWG.

C. For type RHW and RHH, provide insulation conforming to ICEA S-19081. For type XHHW-2, provide insulation conforming to ICEA S-66-524. Provide neoprene jacket on RHW-RR type cables in accordance with ICEA S-19-81 specifications.

D. Provide control cable with 600 volt TW type insulation for all multi-conductor, Class 1 remote control and signal wiring unless otherwise specified. Provide overall jacket complying with ICEA S-61-402. Color code control cable in accordance with ICEA S-61-402, Table 5-1.

E. Minimum conductor size: Provide No. 12 AWG minimum branch circuit wire size. Provide No. 14 AWG control circuits unless otherwise specified or required by over-current protection. Provide smaller conductor sizes for specific applications where minimum size requirements cannot physically be accommodated. Minimum conductor size shall be increased for long runs to accommodate voltage drop as necessary in accordance with NEC requirements.

F. Class 2 remote control and signal conductors: Provide cables UL approved for such use. Voltage rating shall be not less than 600 volts. Utilize multi-conductor cables with like

or related functions generally grouped together. Unless otherwise specified or shown on the drawings, utilize No. 14 AWG conductors.

G. Instrumentation cables: Multi-conductor cables shall have the quantity and size of conductors shown on the plans. Individual conductors shall be bare soft annealed copper Class B, 7-strand concentric per ASTM B-8. Individual conductor insulation shall be flame-retardant per UL 13, 15 mils nominal thickness, with a 105-degree C temperature rating. Conductor pairs shall be uniquely identified according to manufacturer's standard method. Overall cable assembly shall have 2.35 mil (minimum) aluminum-polester tape shield overlapped for 100% coverage and provided with a 7-strand tinned copper drain wire the same size as an individual conductor. The jacket shall be flame-retardant per UL 13, with a 105-degree C temperature rating and a rip cord laid longitudinally under the jacket to facilitate removal. Conductors shall be twisted pairs and the cable shall be rated for operation to 600 volts.

H. Twisted shielded pairs (TSP) shall be 7 or 19-strand, No. 16 AWG minimum, tinned-copper conductors, 600 volt, individually insulated with color-coded cross-linked polyethylene, insulated conductors twisted into a pair, pair-shielded with a spirally applied aluminum/mylar tape shield and a 7-strand drain wire. Cable to have an overall 45 mil jacket.

2.8 MOUNTING HARDWARE

A. Provide PVC coated mounting hardware in exposed corrosive locations. Perma-Cote Industries or approved equal.

PART 3 EXECUTION

3.1 CONDUIT INSTALLATION

A. Conduit buried in earth: Install raceways to provide not less than 30 inches cover to finished grade. Pitch to drain away from buildings; avoid trapped runs. Grade trenches and place pipe bedding material to provide uniform trench bottom for raceway support. Buried raceway shall not be smaller than 1 inch and shall be Schedule 80 PVC as specified. All underground elbows shall be PVC coated RGS.

B. Provide rigid steel conduit for raceways embedded in structural reinforced concrete, for all exposed installations unless otherwise directed in the contract documents; for sizes 1-1/4-inch and larger; and at all locations not otherwise specified.

C. Provide flexible (FLEX) connections at all motors and transformers plus other equipment connections subject to vibration. Utilize suitable fittings, keep route neat, at nominal right angles, and in conformance with equipment lines.

D. Exposed conduit shall be run in straight lines parallel to column lines, walls, or beams. Where conduit is grouped, the bends and fittings shall be installed to present an orderly appearance. Unnecessary bending or crossing shall be avoided.

E. Supports for exposed conduit runs shall be furnished and installed within 3 feet of each box. Supports shall be secured by means of expansion inserts in concrete.

F. Conduit and fittings shall be properly protected during the construction period against mechanical injury from any cause. Conduit which extends out of floors, walls or slabs shall be boxed or otherwise protected and ends shall be capped with metal pipe plugs.

G. Rigid conduit joints and connections shall be made thoroughly watertight and rustproof by means of thread compound which will not insulate the joint. Each threaded joint shall be thoroughly cleaned to remove all the cutting oil before the compound is applied. Running threads will not be allowed. Erickson couplings may be used in dry and exposed locations if they are installed with fixed threaded connection at the top of vertical runs.

H. Size: Use raceways no smaller than 3/4 inch for exposed runs and 1 inch for concealed, embedded or buried runs, but in no instance, shall raceways be smaller than as shown in the circuit schedule or on the Drawings.

I. Raceways in reinforced concrete: Do not displace reinforcing steel to accommodate the installation of raceways and outlet boxes. In general, locate all embedded conduits in the physical center of the particular section of concrete. Wooden plugs inserted in concrete or masonry are not acceptable as a base for raceway fastenings.

J. All fittings, boxes, and supports on PVC coated raceways shall be PVC coated as specified.

3.2 WIRE AND CABLE INSTALLATION

A. Conduit shall be thoroughly cleaned of all foreign material just prior to pulling the wire or cable. Lubricants shall be compounds specifically prepared for cable pulling and shall not contain petroleum or other products that will affect cable insulation. Lubrications shall be UL approved.

B. Splicing of conductors No.8 AWG or smaller shall be by pre-insulated spring-pressure connectors, such as "Scotchlok" Types Y, R and B, or Ideal "Wingnut." Similar products by other manufacturers may be considered for use on this project based on comparison to these lines. Approval of substitutions is solely at the discretion of the Engineer. All uninsulated splices, joints, and free ends of conductors shall be covered with rubber and friction tape or high-dielectric strength, plastic tape. All splices in underground boxes or direct buried shall be insulated and waterproofed, using Scotchcast epoxy splicing compounds suited for the purpose.

C. Terminal strips in panels shall be identified throughout the equipment utilizing unique numbering system at the equipment enclosures and control panels.

D. Wires terminating on terminal strips shall be tagged with the designation of the terminal strip and the number of the terminal to which they are connected. Wires shall be numbered with Brady heat shrink wire markers at all accessible locations. Wire markers shall be permanent type. Submit shop drawings of the type to be used for approval.

E. Wiring diagram shall show the terminal strips, terminals, and their identifying designations.

F. Color code

1. All secondary service, feeder, and branch circuit conductors shall be color coded as follows:

240/120 Volt	Phase	480/277
Black	A	Brown
Red	B	Orange
N/A	C	Yellow
White	Neutral	Gray

2. All No. 14 AWG, No. 12 AWG and No. 10 AWG branch circuit conductors shall have solid color compound or solid color coating. All neutral sizes shall have solid color compound or solid color coating.

3. No. 8 AWG and larger phase conductors shall have either:

   a. Solid color compound or solid color coating.
   b. Stripes, bands, or hashmarks of colors specified above.
   c. Colored pressure-sensitive plastic tape. Tape shall be applied in half overlapping turns for a minimum of 3 inches for all terminal points, and in all junction boxes, pull boxes, troughs, manholes, and handholes. Tape shall be 3/4-inch-wide with colors as specified above. The last two laps of tape shall be applied with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type.

G. Installation: Keep all conductors within the allowable tension limits during installation. Lubricants for wire pulling, if used, shall be approved for the insulation and raceway material. Observe cable manufacturer's and industry standard cable bending radius recommendations. For type THHN/THWN conductors, avoid abrasion and damage to outer jacket. Wiring showing damage after installation shall be replaced by the Contractor at his own expense.

H. 600-volt conductors: Provide one of the conductor types indicated for the function and location listed below unless otherwise indicated on the drawings or approved by the Engineer. Provide ground and neutral wires identical to circuit wires.

I. Observe code restrictions with respect to wet and dry locations. At the Contractor's option, conductors with insulation systems rated for high operating temperatures may be substituted for lower temperature rated conductors. However, no reduction in conductor size will be permitted from that indicated. When using small diameter wire, do not reduce conduit size below that required for Type THW as shown in NEC Table 3A.

LOCATION	THHN/THWN	XHHW-2
Lighting Circuits Interior: General	X	
Special fixture requirements	X	
Within 3 inches of ballast	X	
Receptacle and single-phase	X	
Motor circuits: Interior	X	
Polyphase motor circuits		X
Motor controls	X	
Power outlets		X
Feeders		X
Underground-in raceway		X

J. Wire Pulling:

1. Provide suitable installation equipment to prevent cutting or abrasion of conduits during pulling of feeder.

2. Ropes used for pulling feeders shall be made of suitable non-metallic material.

3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Engineering.

4. All cables in a single conduit shall be pulled in together.

5. The cable jacket and/or conduit walls shall be completely lubricated when cable is pulled into conduit. The lubricant shall be applied immediately before or during a pull. Minimum quantities of lubricant are as follows:

   a. One (1) quart of lubricant per 100 feet of 1-inch conduit
   b. Two (2) quarts of lubricant per 100 feet of 2-inch conduit.
   c. Three (3) quarts of lubricant per 100 feet of 3-inch conduit.
   d. One (1) gallon of lubricant per 100 feet of 4-inch conduit.

e. This quantity shall be increased as needed for difficult pulling situations (high temperatures, multiple bends, poorly placed conduit, etc.)

K. Cable Installation:

1. Install medium-voltage cable as indicated, according to manufacturer's written instructions and IEEE 576.

2. Pull conductors simultaneously where more than one cable is indicated in same raceway. Use NRTL-listed and manufacturer-approved pulling compound or lubricant where necessary. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

3. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit and support cables at intervals adequate to prevent sag.

4. Install terminations at ends of conductors with standard kits. Conform to manufacturer's written instructions. Comply with classes of terminations indicated.

3.3 MANHOLES AND HANDHOLES

A. Inspect actual field conditions at the proposed location for each manhole and handhole and verify that it is free from interference with other utilities and free of flooding due to the characteristic flow of surface water. Make minor relocations as required to clear obstructions and minimize flooding. Set all manholes and handholes on a 24-inch deep rock bed. Provide a gasket and grout between all extension sections to seal manholes watertight.

B. Conduits generally shall enter the handhole or manhole at approximate right angles to the wall and as near as possible to one end of the wall, unless otherwise indicated. Grout around all conduits and duct banks entering the manhole or handhole.

C. Install 10-foot-long ¾ inch copper clad ground rod in each handhole. Bond all handhole metal parts with minimum No. 6 AWG bare copper ground conductor.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED WORK

A. Section 26 05 90, Electrical Work, General
B. Section 26 00 05, Electrical Materials and Methods
C. Section 26 50 00, Lighting

1.2 SYSTEM DESCRIPTION

A. Provide grounding and bonding of electrical service, circuits, equipment, signal and control systems.

B. Performance Requirements: Supplement the grounded neutral of the secondary distribution system with an equipment grounding system to properly safeguard the equipment and personnel. Install equipment grounding such that all metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items near electrical circuits operate continuously at ground potential and provide a low impedance path for possible ground fault currents.

1.3 SUBMITTALS

A. Provide Shop drawings and product data for the grounding material.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of the NEC, latest adopted version with amendments by local Authority Having Jurisdiction (AHJ).

B. Furnish products listed by UL or other testing firm acceptable to AHJ.

1.5 SEQUENCING AND SCHEDULING

A. Building Ground Electrode: Coordinate placement of ground rods and grounding electrode conductor in base of building footing prior to placement of concrete. Coordinate bonding of rebar with rebar installer prior to rough-in.

PART 2 PRODUCTS

2.1 MATERIALS

A. Ground Rods: Copperclad steel, 3/4-inch diameter, 10-feet long, tapered point, chamfered top. Manufacturers: Weaver, Thomas & Betts, Talley, or approved equal.

B. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors. Mechanical types of connectors are not acceptable. Manufacturers: Burndy Hyground Compression System, Erico/Cadweld, Amp Ampact Grounding System or approved equal.

C. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe. Burndy GAR Series, O–Z Gedney, Thomas & Betts or approved equal.

D. Telecommunications Grounding Bar: 1/4-inch thick by 4-inch high by 20-inch long copper ground bar with insulators. Manufacturers: Erico/Cadweld or approved equal.

E. Grounding Electrode Conductor: Bare copper stranded conductor.

PART 3 EXECUTION

3.1 INSTALLATION

A. Concrete Encased Ground Electrode:

1. From the service equipment ground bus install grounding electrode conductor to footing foundation rebar.

2. Bond the grounding electrode conductor to three independent steel rebars. Each rebars minimum length is 20-feet.

3. Protect grounding electrode conductor extension from footing/foundation to service equipment with rigid PVC conduit. Do not use metal conduit for grounding electrode conductor protection.

B. Water Service Grounding: Bond building ground electrode and water service pipe to service ground bus. Connect to water pipe on utility side of isolating fittings or meters, bond across water meters.

C. Raceways:

1. Ground all metallic raceway systems. Bond to ground terminal with code size jumper except where National Electric Code (NEC) code size or larger grounding conductor is included with circuit, use grounding bushing with lay-in lug.

2. Connect all metal raceways, which terminate within an enclosure but without mechanical connection to the enclosure, by grounding bushings and ground wire to the grounding bus.

3. Where equipment supply conductors are in flexible metallic conduit, install stranded copper equipment grounding conductor from outlet box to equipment frame.

4. Install equipment grounding conductor, code size minimum unless noted on Drawings, in all nonmetallic and metallic raceway systems.

D. Feeders and Branch Conduits:

1. Install continuous insulated equipment copper ground conductors within the following circuits; feeders, circuits for computer systems and other circuits as indicated on the Drawings.

2. Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment ground conductors for feeders and branch circuits sized in accordance with NEC Table 250-95.

E. Boxes, Cabinets, Enclosures and Panelboards:

1. Bond grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.

2. Bond all sections of service equipment enclosure to service ground bus.

F. Motors, Equipment and Appliances: Install code size equipment grounding conductor from outlet box to (motor) equipment frame or manufacturer's designated ground terminal.

G. Receptacles: Connect ground terminal of receptacle to equipment ground system by No. 14 American Wire Gauge (AWG) conductor bolted to outlet box except isolated grounds where noted. Self grounding nature of receptacle devices does not eliminate conductor bolted to outlet box.

H. Telecommunications Backboard: provide telecommunications grounding bar at each telecommunications backboard. Bond the grounding bar to service grounding bar in

the main service equipment with a No. 6 AWG copper equipment grounding conductor.

I. Separately Derived Systems: Ground each separately derived system per NEC 250-26.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Labels.
3. Wire markers.
4. Conduit markers.
5. Stencils.
6. Underground Warning Tape.
7. Lockout Devices.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Submit manufacturer’s catalog literature for each product required.

2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Samples:

1. Submit two samples of each type of identification products applicable to project.

2. Submit two nameplates, 4 x 4 inch in size illustrating materials and engraving quality.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with State of Washington and Lewis County Public Work's standards.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 10 00 - Summary of Work: Requirements for transporting, handling, storing, and protecting products.

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 10 00 - Summary of Work: Environmental conditions affecting products on site.

B. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

1.8 EXTRA MATERIALS

A. Section 01 33 00 - Submtital Procedures: Requirements for extra materials.
B. Furnish two containers of spray-on adhesive.
C. Furnish two rolls of film adhesive.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:

1. Seton Identification Products
2. Substitutions: Approved equals only

B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

C. Letter Size:

1. 1/8-inch-high letters for identifying individual equipment and loads.
2. 1/4-inch-high letters for identifying grouped equipment and loads.

D. Minimum nameplate thickness: 1/8 inch.

2.2 LABELS

A. Manufacturers:

1. Seton Identification Products
2. Brady
3. Substitutions: Approved equals only.

B. Labels: Embossed adhesive tape, with 3/16-inch black letters on white background.

2.3 WIRE MARKERS

A. Manufacturers:

1. Brady
2. Ideal
3. Raychem
4. Substitutions: Approved equals only

B. Description: shrink tubing type wire markers with machine printed lettering only.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder numbers.
2. Control Circuits: Control wire number as indicated on shop drawings.

2.4 CONDUIT AND RACEWAY MARKERS

A. Manufacturers:

1. Seton Identification Products
2. Brady
3. Ideal
4. Substitutions: Approved equals only.

B. Description: Nameplate fastened with straps or Labels fastened with adhesive.

C. Color:

1. 480 Volt System: Black lettering on orange background.
2. 240 Volt System: Black lettering on orange background.

D. Legend:

1. 480 Volt System: 480 VOLTS.
2. 240 Volt System: 120/240 VOLTS.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:

1. Seton Identification Products
2. Brady
3. Substitutions: Approved equals only.

B. Description: 4-inch-wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

2.6 LOCKOUT DEVICES

A. Lockout Hasps:

1. Manufacturers:

a. Brady
b. Master Lock
c. Substitutions: Approved equals only.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.
B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.2 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.
B. Install identification on unmarked existing equipment.
C. Replace lost nameplates, labels and markers.

3.3 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:

1. Install nameplate parallel to equipment lines.

2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or epoxy adhesive.

3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.

4. Secure nameplate to equipment front using epoxy adhesive.

5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.

6. Install nameplates for the following:

    a. Control Panels.
    b. Panelboards.
    c. Feeder Breakers.
    d. Vaults, Junction and Pull Boxes.

C. Label Installation:

1. Install label parallel to equipment lines.
2. Install label for identification of individual control device stations, and instruments.
3. Install labels for permanent adhesion and seal with clear lacquer.

D. Wire Marker Installation:

1. Install wire marker for each conductor at control panels, pull boxes, outlet and junction boxes, and each load connection.

2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.

3. Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.

E. Conduit and Raceway Marker Installation:

1. Install conduit or raceway marker for each conduit or raceway] longer than 6 feet.
2. Conduit and Raceway Marker Spacing: 20 feet on center.

F. Underground Warning Tape Installation:

1. Install underground warning tape along length of each underground conduit, raceway, or cable 8 to 12 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

SECTION 26 05 90

ELECTRICAL WORK, GENERAL

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The work consists of furnishing all labor, materials, services, tools and other equipment necessary for the construction, installation, connection and testing of all electrical work for this project as shown on the drawings or specified herein.

B. This project includes the complete electrical and control system for a new storage reservoir at the City of Vader, Washington Water Treatment facility.

1.2 INTENT OF DRAWINGS AND SPECIFICATIONS

A. Riser and other diagrams are schematic only and shall not be used for obtaining quantities.

B. The electrical drawings do not show complete details of the site conditions. The Contractor shall check actual conditions.

1.3 COORDINATION OF WORK

A. The Contractor shall plan his work in coordination with the City Operations.

B. The Contractor shall field verify all dimensions of equipment to be installed or provided by others or by this contract so that correct clearances and connections may be made between the work installed by the Contractor and equipment installed or provided by others.

C. The Contractor shall arrange all conduit runs so that they do not interfere with duct work, structural members, equipment access openings, etc.

D. All working measurements shall be taken from the sites, checked with those shown on the drawings, and if they conflict, reported to the Engineer at once, and before proceeding with the work. Should the Contractor fail to comply with this procedure, he shall alter his work at his own expense as directed by the Engineer.

E. No extra payments will be allowed where obstructions in the work of other trades, or work under this contract requires offsets to conduit runs.

F. The Contractor is responsible for all alterations in the work to accommodate equipment differing in dimensions or other characteristics from that shown or specified.

1.4 SUPERVISION

The Contractor shall maintain adequate supervision of the work and shall have a responsible person in charge at the site during all times that work under this contract is in progress, or when necessary for coordination with other work.

1.5 CODES

Work shall conform to the National Electrical Code, Washington State codes, and other applicable codes, even though not specifically mentioned for each item. These shall be regarded as the minimum standard of quality for materials and workmanship.

1.6 WORKMANSHIP

A. All work shall be performed by personnel skilled in the particular trade. Workmanship shall conform to the standards of the NEC, NFPA-70 2017.

B. The Engineer shall be the sole authority as to whether the finished work is satisfactory; and if in his judgement any material or equipment has not been properly installed or finished, the Contractor shall replace the material or equipment whenever required, and reinstall it in a manner entirely satisfactory to the Engineer without any increase in cost to the Owner.

1.7 PERMITS, FEES AND SERVICE CHARGES

The Contractor shall obtain all permits and pay all fees, including any line extension fees from any utility company.

1.8 CONTRACTOR'S RECORD DRAWINGS

The Contractor shall maintain a neatly marked set of record drawings. In addition, the locations of panels, field mounted instruments and panels, terminal boxes, junction boxes and any other materials included in this contract shall be shown. Drawings shall be kept current with the work as it progresses and shall be subject to inspection by the Engineer at any time.

PART 2 PRODUCTS

2.1 MATERIALS

See subsequent electrical sections and the drawings for specified materials.

2.2 PORTABLE OR DETACHABLE PARTS

A. The Contractor shall retain in his possession and shall be responsible for all portable and detachable parts or portions of installations such as fuses, key locks, adaptors, blocking chips, and inserts until completion of his work.

B. These parts shall be delivered to the Engineer and an itemized receipt obtained. This receipt, together with 2 copies of the final inspection certificate, shall be attached to the Contractor's request for final payment.

C. All equipment shall be demonstrated to operate in accordance with the requirements of this specification and the manufacturer's recommendations.

PART 3 EXECUTION

3.1 SUPPORT BACKING

Provide any necessary backing required to properly support all fixtures and equipment installed under this contract.

3.2 CUTTING, PATCHING AND FRAMING

A. The Contractor shall determine in advance the locations and sizes of all sleeves, chases, and openings necessary for the proper installation of his work.

B. Whenever practical, inserts or sleeves shall be installed prior to covering work. Cutting and patching shall be held to a minimum. All required holes in concrete construction shall be made with a core drill and patched with non-shrink grout.

C. Cutting, fitting, repairing and finishing of carpentry work, metal work, or concrete work, and the like, which may be required for this work shall be done by craftsmen skilled in their respective trades. When cutting is required, it shall be done in such a manner as not to weaken walls, partitions, or floors; and holes required to be cut in floors must be drilled without breaking out around the holes.

3.3 TESTS

A. The Contractor shall furnish all labor, material, instruments and tools to make all connections for testing of the electrical and instrumentation installation. All equipment shall be demonstrated as operating properly prior to the acceptance of the work. All protective devices shall be operative during testing of equipment. The tests shall be made under the supervision of the Engineer. All deficiencies or unsatisfactory conditions as determined by the Engineer or inspecting authorities shall be corrected by the Contractor in a satisfactory manner at his own expense.

B. After visual inspection of joints and connections and the application of tape and other insulating materials, all sections of the entire wiring system shall be thoroughly tested for shorts and grounds. A log of results for each circuit shall be kept by the Contractor and presented to the Engineer.

C. A phase rotation check shall be made to demonstrate that all power receptacles, service feeders, and main power feeders have the same A-B-C phase rotation and ground relationships.

D. Equipment shall be tested by operating all electric motors, relays, controls, switches, heaters, etc. sufficiently to demonstrate proper installation and electrical connections. Control and emergency conditions shall be artificially simulated where necessary for complete system or subsystem test.

E. Insulation resistance measurements of each circuit shall be made with loads connected and contactors, if any, blocked closed to give complete circuits. Insulation resistance of complete circuit shall be measured from the circuit breaker load terminals with the breaker open. A log of complete results shall be prepared by the Contractor and presented to the Engineer. Values of resistance shall be 10 megaohms or greater.

END OF SECTION

SECTION 26 09 16

MOTORS AND CONTROLS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

Work consists of all motors and control shown on the drawings and specified herein and in other divisions of the specifications. In general, all motors shall be furnished with the driven equipment. The requirements of all other sections of the specifications are equally applicable to the work to be performed under this section. Motors and controls are specified in this and other divisions of the specifications. In the event of conflicts, the more restrictive specifications shall apply.

1.2 SHOP DRAWINGS

Submit shop drawings of the following for approval of the Engineer.

A. Solid State Reduced Voltage Motor Starters. (SSRV)

B. Full Voltage Non-Reversing Motor Starters. (FVNR)

C. Full Voltage Reversing Motor Starters. (FVR)

D. Variable Frequency Drive. (VFD)

E. Pilot control devices including hand switches, pilot lights, relays, etc.

F. Prewired motor control panels:

1. General descriptive literature of the manufacturer's standard equipment.

2. Complete panel layout including construction details.

3. Complete Bill of Materials (BOM).

4. Schematic and ladder diagrams of internal control wiring of each unit and connections and functioning of outside control devices required for the installation.

5. Complete composite diagram showing wiring of power and control, interconnections between sections, terminal markings and wire size.

G. Complete schedule of nameplate legends.

PART 2 PRODUCTS

2.1 SERVICE CONDITIONS

All equipment shall be designed and built for industrial service and can operate successfully under the following applicable conditions.

A. 40 degrees C maximum ambient temperature

B. Voltage variations to ± 10% of nameplate rating

C. Frequency variations to ± 5% of nameplate rating

D. Combined voltage and frequency variations to ± 10% total, as long as frequency does not exceed ± 5%

E. 3,300-foot maximum altitude

2.2 MOTOR CONTROL

A. General

1. Furnish and install a complete motor control system as specified, shown on the drawings or required for the control and protection of all motors and motor-operated equipment in conformance with manufacturer's recommendations and applicable codes.

2. This section of the specification applies to all motor controls specified herein and in other sections of the specification.

3. All controls shall conform to the requirements of NEMA standards latest revision.

4. Motor control components shall be manufactured by GE, Eaton, Square D, Allen Bradley or approved equal.

B. Control requirements -- Provide for each motor a suitable controller and devices that will perform the functions specified or shown on the drawings for the respective motor. Each motor shall be provided with thermal overload protection.

1. Single-phase motors shall be self-protected, and control shall be through manual switches or automatic contacts as specified or indicated on the drawings.

2. Polyphase motors shall have thermal overload heater elements provided integral in the motor controller for each ungrounded conductor.

C. Overload relays

1. Polyphase motor protection shall utilize standard melting alloy overload units. Adjustment range shall be 85% to 115% of the unit's basic current rating. Utilize standard trip characteristic units unless otherwise recommended by the manufacturer. Make the initial setting of overload units to provide a maximum of 115% protection or equal to the motor-rated service factor current whichever is less.

2. Adjust and/or replace thermal overload units initially provided under this contract as required to provide the closest possible, trouble-free, thermal overload protection consistent with the motor, control and driven equipment manufacturer's recommendations and sound application practice including but not limited to consideration of motor service factor, special motor characteristics and ambient temperature conditions at the motor and controller locations.

3. Manual reset shall be utilized for all overload relays installed integral with motor controllers and shall have external reset pushbuttons.

D. Controller

1. Manual controllers shall be utilized where specifically indicated on the drawings or specified. Provide switches which are horsepower rated for the load served.

2. Magnetic motor starters shall be utilized at all locations unless otherwise noted. Controllers shall be AC full-voltage unless otherwise noted or required, NEMA Size 1 minimum, or larger. Magnetic motor starters shall be type FVNR or FVR as described in this section. Acceptable manufacturers shall be GE, Eaton, Square D or approved equal.

E. Pilot Devices

1. Operate 120-volts unless otherwise noted.

2. Pushbutton, selector switches and pilot lights shall be as follows unless otherwise indicated.

   a. Push-buttons -- Oil tight, heavy-duty type

   b. Pilot Lights -- Provide oil tight heavy-duty, 125-volt transformer push-to-test type with 6-volt LED lamp and lens colors as shown

3. Running time meter -- Provide a running time meter where indicated. Utilize a non-resettable unit with four registers to indicate up to 9,999 hours.

F. Combination starters -- Combine the above specified or indicated control functions in a common enclosure with a "magnetic only" molded-case circuit breaker.

G. Installation

1. The contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

2. All necessary hardware to secure the assembly in place shall be provided by the contractor.

3. The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to:

a. Check to ensure that the pad location is level to within 0.125 inches.

b. Check to ensure that all bus bars are torqued to the manufacturer's recommendations.

c. Assemble all shipping sections, remove all shipping braces and connect all shipping split mechanical and electrical connections.

d. Secure assemblies to foundation or floor channels.

e. Measure and record Megger readings phase-to-phase, phase-to-ground, and neutral-to-ground (four-wire systems only).

f. Inspect and install all circuit breakers in their proper compartments.

2.3 ELECTRIC MOTORS

A. General -- Electric motor driven pumps shall be furnished with vertical solid shaft electric motors, design B, high thrust, squirrel cage, induction type having NEMA weather protected type I enclosures unless otherwise specified. Motors shall be suitable electrically and mechanically to efficiently and effectively drive pumps. Motors shall operate in accordance with these specifications.

B. Motors shall couple to the pumps using a four-piece, adjustable spacer type coupling for connection of the solid shaft to the pump line shaft. Coupling shall allow for removal of pump seal without removing the motor.

C. Unless specified otherwise, all materials, workmanship and tests shall conform with the applicable specifications to NEMA, IEEE, ASA and AFBMA.

D. Motor frame shall be steel or cast iron, aluminum shall not be permitted. Motors shall be rated for operation at 460 VAC, 3 phase, 60 hertz, Service factor of 1.15 or greater.

Motors shall operate at standard RPM's as required by the pump or equipment which they drive. Motors shall be rated for premium efficiency. Rated efficiencies shall be based on NEMA standards MG1-12.536 or standards imposed by the local electric utility, whichever is more restrictive.

E. Motors shall be suitable for across the line starting and shall be able to start and accelerate the connected load to full speed with 90% of rated voltage at the motor terminals. Motors shall be capable of full load operation with voltage variations of +/- 10% and frequency variation of +/- 5%.

F. Motor starting current shall not exceed 650% of motor full load current.

G. Insulation system: All motors shall be provided with Class "F" or better insulation systems except that motor lead insulation may be class "B" or better. Completed windings, when tested in accordance with IEEE #57 shall show a thermal rating not less than 150 degrees for 30,000 hours of life.

H. Windings shall be held firmly in stator slots to prevent coil shift. Stator windings shall be of high conductivity copper magnet wire. Completed stator windings shall be provided with a properly cured, uniform impregnation for mechanical rigidity, moisture resistance, and protection against winding failure from accumulation of foreign conductive matter. The completed insulation system shall be capable of withstanding phase to ground rms voltage of 600 volts continuous and 2,300 volts instantaneous.

I. Rated temperature rise above 40 degrees C ambient temperature, at service factor load of 1.15 shall not exceed 90 degrees C.

J. Motors rated 50 Hp and larger shall be rated NEMA locked rotor Code G or better.

K. Motors shall be dynamically balanced to a maximum of .001 inches peak to peak amplitude.

L. Motors shall be equipped with anti-friction type thrust and guide bearings. Angular contact thrust bearings shall be used. Bearings shall be of sufficient capacity to withstand all static and dynamic thrust loads, both momentary and continuous, imposed by the pump. Bearings shall provide minimum 3-year life based on continuous design thrust loads.

M. Motor thrust bearings shall be oil lubricated. Oil lubrication systems shall provide optimum lubrication of bearings. Oil lubricated motors shall have visual level indicators and accessible fill and drain plugs.

N. Motors shall be equipped with non-reverse mechanisms which shall limit maximum reversal to 10 degrees of rotation.

O. Motors shall be equipped with extra large heavy-duty split type conduit boxes.

P. Motor Nameplates shall include Manufacturer name, serial number, rated horsepower, service factor, frequency, phase, load voltage, full load amps, full load speed, design designation, locked rotor current and or designation, insulation class, temperature rise, ambient temperature, NEMA efficiency, and full load power factor.

Q. Motors shall be as manufactured by GE, US Motors, Baldor or approved equal.

2.4 SOLID STATE REDUCED VOLTAGE STARTER

A. Solid-state reduced voltage starter (controller) used shall be Allen-Bradley SMC Dialog Plus Controllers with pump control option and bypass contactors (rated for use for across the line starting), or approved equal.

B. Motor overload protection shall be manufacturers recommended method.

2.5 PREWIRED PUMP CONTROL PANELS

Prewired pump control panels shall use components as listed in 2.2 above and shall comply with Section 40 95 13 – Process Control Panels and Hardware.

PART 3 EXECUTION

3.1 GENERAL

Install equipment and materials in a neat and workmanlike manner and align, level and adjust for satisfactory operation. Install equipment so that all parts are easily accessible for inspection, operation, maintenance, and repair.

3.2 WIRING

Arrange wiring in cabinets, panels and motor control centers neatly cut to proper length, and remove surplus wire. Apply ratchet crimped terminal lugs to control wiring for connection to terminal blocks, and bridle and secure in an approved manner. List all circuits emanating from power, distribution and lighting panelboards by function on the directory card. Identify all circuits entering motor control centers or other control cabinets by directory card listing terminal block number and function or by means of tags securely fastened to the conductors.

END OF SECTION

SECTION 26 50 00

LIGHTING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. This Section specifies outdoor lighting system as specified and as shown on the drawings.

1.2 LISTING AND LABELING

A. All equipment shall be listed and labeled for the purpose for which it is used by Underwriters Laboratories.

1.3 SUBMITTAL

A. Submittal after award of Contract shall include the following as a minimum:

1. Catalog information describing luminaire make, materials, features, finish, ballast, lamp, and dimensions.

PART 2 PRODUCTS

2.1 LUMINAIRES

A. Luminaires shall be as shown on the drawings.

2.2 EXERIOR FLOOD LIGHT

A. General: Luminaire shall be outdoor, metal halide, UL listed for wet location, 40 degrees C ambient temperatures, and shall be CSA certified. Luminaire shall be similar and equal to that shown on the luminaire schedule on the drawings. The wattage shall be as shown on the drawings. Provide quartz restrike.

B. Housing: Watertight die-cast aluminum housing and door finished in weather-resistant dark bronze polyester powder coat enamel.

C. Optical and socket assembly: specular aluminum, one-piece reflector for sharp beam cutoff. The socket shall be porcelain enclosed screw-shell for mogul base HID lamps.

D. Lamp: metal halide pulse start 1,500 hour coated lamp, 3700 K, 70 CRI. The wattage shall be as shown on the drawings.

E. Ballast: shall be copper wound, high power factor multi-tap 120/208/240/277 volt. The ballast shall reliably start the lamp in ambient temperatures to minus ten degrees F.

2.3 FLOOD LIGHT POLE

A. Height and other features shall be as shown on the drawings. Poles shall be rated for 90 mph wind loading.

B. Pole shall include shaft, support plate, anchor base, anchor bolts, and nuts.

2.4 POLE BASE

A. Provide reinforced stainless-steel pole base as required by pole manufacturer and as shown on the drawings.

PART 3 EXECUTION

3.1 GENERAL

A. General location and Type of luminaires shall be as shown on the drawings. Coordinate installation with other trades.

B. Provide necessary support system and raceway to complete a functional system. Luminaire shall be directly and rigidly mounted on their support structures. Unless otherwise specified, conduit system shall not be used to support fixtures. Where brackets or supports for luminaires are welded to steel members, the welded area shall be cleaned, treated with rust-resistant primer and finish painted to match.

C. Luminaires labeled to require conductors with a temperature rating exceeding 75 degrees C shall be spliced to circuit conductors in a separately mounted junction box. Luminaires shall be connected to junction box using flexible conduit with temperature rating equal to that of the luminaire.

D. All lamps installed under this contract that have been operated for more than half their rated life, shall be replaced when the project is ready for acceptance.

E. Luminaires shall be cleaned when project is ready for acceptance.

F. Luminaires shall be aligned and directed to illuminate an area as specified and shown on the drawings.

3.2 INSTALLATION OF FLOOD LIGHT

A. Install flood light as indicated and in accordance with the manufacturer’s installation instructions and recommendations.

3.3 LIGHT POLES

A. Install light pole as indicated and in accordance with the manufacturer’s installation instructions.

END OF SECTION

SECTION 31 05 13

SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes a range of soil and subsoil materials intended to be referenced by other sections, generally for fill and grading purposes. Materials are indicated by "Type" to assist in referencing from other sections and on Drawing notes.

B. Section includes:

1. Subsoil materials.
2. Topsoil materials.

1.2 RELATED SECTIONS

A. Section 31 05 16 - Aggregates for Earthwork.
B. Section 31 10 00 – Site Clearing.
C. Section 31 22 13 - Rough Grading.
D. Section 31 23 16 – Excavation.
E. Section 31 23 17 - Trenching.
F. Section 31 23 23 - Fill.
G. Section 31 37 00 - Riprap.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

B. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

2. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

3. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Materials Source: Submit name of imported materials source.
C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Furnish materials of each type from same source throughout the Work.

B. Soil Testing:

1. Soil sampling and testing to be completed by an independent laboratory approved by the Engineer.

2. Frequency of testing shall be determined by the Engineer.

3. All soil testing shall be paid for by the Contractor.

C. Compaction Tests:

1. Maximum density at optimum moisture content determined by ASTM D698 (AASHTO T99).

2. In-place density in accordance with Nuclear Testing Method, ASTM D6938.

D. Soil Classification: All imported materials shall be classified in accordance with ASTM D2487.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

A. Subsoil Type S1, Select Native Material:

1. Select earth obtained from on-site excavations approved for use by Engineer.

2. Graded.

3. Free of peat, humus, vegetative matter, organic matter and rocks larger than 4 inches in diameter.

4. Processed as required to be placed in thickness as prescribed and at the optimum moisture content to obtain level of compaction required by these specifications.

B. Subsoil Type S2, Imported Granular Fill Material:

1. Imported earth approved for use by Engineer.

2. Hard, durable fragmental rock up to 4 inches in diameter and less than 7% passing the No. 200 sieve (washed analysis).

2.2 TOPSOIL MATERIALS

A. Topsoil Type TS1, Select Native Topsoil Material:

1. Meeting the requirements of WSDOT 9-14.1(2), Topsoil Type B.

B. Topsoil Type TS2, Imported Topsoil Material:

1. Meeting the requirements of WSDOT 9-14.1(3), Topsoil Type C.

2.3 SPOILS

A. All excess material not suitable or not required for backfill and grading shall be hauled off site and disposed of at a location provided by the Contractor and approved by the Engineer.

B. Make arrangements for disposal of the material at no additional cost to the Owner.

C. Landfill permit to be obtained by the Contractor and provided to Engineer prior to commencement of disposal.

2.4 SOURCE QUALITY CONTROL

A. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698 (AASHTO T99).

B. When tests indicate materials do not meet specified requirements, change material or vary compaction methods and retest. Additional testing shall be completed and paid for by the Contractor with no reimbursement by the Owner.

C. Furnish materials of each type from the same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate material of every nature and description to the lines and grades as indicated on the Drawings and/or as required for construction of facilities.

B. Site within clearing limits shall be stripped of topsoil as required to obtain additional topsoil necessary to complete Work indicated in the Drawings or as specified.

C. When practical, do not excavate wet top soil.

D. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

E. Remove excess excavated subsoil and topsoil not intended for reuse from Site.

F. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from Site.

3.2 STOCKPILING

A. Stockpile soils at locations shown in the Drawings or at locations as approved by Engineer for redistribution as specified.

1. Site may not have sufficient area to stockpile excavated material that will be required for fill later in the project. If additional stockpile area is required to complete the Project on schedule, arrange off-site stockpile areas.

2. No additional payments will be made for stockpiling excavated materials off-site.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Prevent intermixing of soil types or contamination.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

1. Grade surface of stockpiles to prevent ponding of water.
2. Cover stockpiles to minimize the infiltration of water.

F. Stockpile unsuitable and/or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 05 16

AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes a range of coarse and fine aggregate materials intended to be referenced by other Sections, generally for fill and grading purposes. Materials are indicated by "Type" to assist in referencing from other Sections and in Drawing notes.

B. Section Includes:

1. Coarse aggregate materials.
2. Fine aggregate materials.

1.2 RELATED SECTIONS

A. Section 31 05 13 - Soils for Earthwork.
B. Section 31 10 00 – Site Clearing.
C. Section 31 22 13 - Rough Grading.
D. Section 31 23 16 - Excavation.
E. Section 31 23 17 - Trenching.
F. Section 31 23 19 - Dewatering.
G. Section 31 23 23 - Fill.
H. Section 31 37 00 - Riprap.
I. Section 32 11 23 - Aggregate Base Courses.
J. Section 33 11 10 - Water Utility Distribution Piping.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.

2. AASHTO T27 - Sieve Analysis of Fine and Coarse Aggregates.

3. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

4. AASHTO TP61 - Standard Method of Test for Determining the Percentage of Fracture in Coarse Aggregate

B. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

4. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

5. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Materials Source: Submit name of imported materials suppliers.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Results of aggregate sieve analysis and standard proctor tests for all granular material.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Aggregate Testing:

1. Aggregate sampling and testing to be completed by an independent laboratory approved by the Engineer.

2. The frequency of testing shall be determined by the Engineer.

3. All aggregate testing shall be paid for by the Contractor.

C. Compaction Tests:

1. Maximum density at optimum moisture content determined by ASTM D698. (AASHTO T99).

2. In-place density in accordance with Nuclear Testing Method, ASTM D6938.

D. Aggregate Classification: All imported materials shall be classified in accordance with ASTM D2487.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Coarse Aggregate Type A1, Crushed Surfacing: Crushed rock as shown in the Drawings and meeting the requirements provided below.

1. The aggregates shall conform to the grading requirements of WSDOT Standard 9-03.9(3) for Base Course and Top Course.

B. Coarse Aggregate Type A2, Granular Drain Backfill Material: Crushed or uncrushed rock or gravel as shown in the Drawings.

1. The aggregates shall conform to the grading requirements of WSDOT Standard 9-03.12(4) for Gravel Backfill for Drains.

C. Coarse Aggregate Type A3, Granular Foundation Backfill Material: Crushed or uncrushed rock or gravel as shown in the Drawings.

1. The aggregates shall conform to the grading requirements of WSDOT Standard 9-03.12(1) for Gravel Backfill for Foundations, Class A or Class B.

D. Coarse Aggregate Type A4, Granular Pipe Zone Backfill Material: Crushed or uncrushed rock or gravel as shown in the Drawings.

1. The aggregates shall conform to the grading requirements of WSDOT Standard 9-03.12(3) for Gravel Backfill for Pipe Zone Bedding.

2.2 SAND

A. Sand: Sand material shall consist of granular material, naturally produced or produced from crushed gravel, or dredge sand that is reasonably free of organic material, mica, clay, fly ash and other deleterious material, meeting the gradations of Table 310516-C below.

Table 310516-A
Grading Requirements for Sand (Separated Sizes)
Percent Passing (by weight)

Sieve Size	Coarse Sand	Medium Sand	Fine Sand
1”	100	100	100
3/8”	95 - 100	95 - 100	-
#4	80 - 100	70 - 95	90 - 100
#30	10 - 30	10 - 45	-
#100	-	2 - 10	2 - 10
#200	0 - 8	0 - 7	0 - 4
Sand Equivalent	50 min.	50 min.	50 in.

2.3 SOURCE QUALITY CONTROL

A. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM C136 and ASTM D698 (AASHTO T99).

B. Sand - Testing and Analysis: Perform in accordance with ASTM C136 and ASTM D698 (AASHTO T99).

C. When tests indicate materials do not meet specified requirements, change material and retest. Additional testing shall be completed and paid for by the Contractor with no reimbursement by the Owner.

PART 3 EXECUTION

3.1 STOCKPILING

A. Stockpile materials imported to site at shown in the Drawings or at locations as approved by Engineer for redistribution as specified.

B. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

C. Prevent intermixing of aggregate types or contamination.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

1. Grade surface of stockpiles to prevent ponding of water.
2. Cover stockpiles to minimize the infiltration of water.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes clearing site of incidental paving and curbs, debris, grass, trees, and other plant life in preparation for site or building excavation work.

1.2 RELATED SECTIONS:

A. Section 01 56 39 - Tree and Plant Protection.
B. Section 02 41 00 - Demolition.
C. Section 31 22 13 - Rough Grading.
D. Section 31 23 18 - Rock Removal.

1.3 DEFINITIONS

A. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.

B. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 1/2-inch caliper to a depth of 18 inches below grade.

C. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.

D. Limits of Disturbance: Work area boundary as shown on the Plans.

E. Root Wad: Tree stump and root mass including all roots greater than 1/2-inch diameter.

F. Stripping: Removal of topsoil remaining after applicable scalping is completed.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Clearing, Grubbing and Stripping Plan: Drawings clearly showing proposed limits to clearing, grubbing and stripping activities at Site.

C. Certification or disposal permit for landfill and/or waste disposal site.

D. A copy of written permission of private property owners, with copy of fill permit for said private property, as may be required for disposal of materials.

1.5 QUALITY ASSURANCE

A. Existing Conditions: Determine the extent of Work required and limitations before proceeding with Work.

B. Obtain Engineer's approval of staked clearing, grubbing, and stripping limits prior to commencing clearing, grubbing, and stripping.

C. Conform to applicable local, state and federal codes for environmental requirements and disposal of debris,

1. Burning on project site will not be permitted.
2. Use of herbicides will not be permitted.

D. Permits: The Contractor is responsible for obtaining all necessary permits required for completion of the Work described in this Section.

E. Protection of Persons and Property: Meet all federal, state and local safety requirements for the protection of laborers, other persons, and property in the vicinity of the work and requirements of the General Provisions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Existing Materials: All materials, equipment, miscellaneous items and debris involved, occurring or resulting from demolition, clearing and grubbing work shall become the property of the Contractor at the place of origin, except as otherwise indicated in the Drawings or specifications.

B. Wound Paint: Emulsified asphalt formulated for use on damaged plant tissues.

PART 3 EXECUTION

3.1 GENERAL

A. Clear, grub, and strip areas needed for waste disposal, borrow, or Site improvements within limits shown in approved Clearing, Grubbing and Stripping Plan.

B. Remain within the property lines at all times.

C. Do not injure or deface vegetation or structures that are not designated for removal.

3.2 EXAMINATION

A. Verify existing plant life designated to remain is tagged or identified.
B. Identify waste and salvage areas for placing removed materials.

3.3 PREPARATION

A. Carefully coordinate the work of this Section with all other work and construction.

B. Call Local Utility Line Information service at 1-800-424-5555, not less than three working days before performing Work.

C. Request underground utilities to be located and marked within and surrounding construction areas.

1. Disconnect or arrange for disconnection of utilities (if any) affected by required work.

2. Keep all active utilities intact and in continuous operations.

D. Prepare Site only after:

1. Erosion and sediment controls are in place.

a. Limit areas exposed uncontrolled to erosion during installation of temporary erosion and sediment controls and in compliance with COP Erosion and Sediment Control Manual and ESC Permits.

2. Tree and vegetation protection is installed.

a. Protect existing site improvements, trees and shrubs to remain to preclude damage during construction.

3. Temporary fencing is installed along the Limits of Disturbance.

4. Notification of utility agencies; disconnect or arrange for disconnection of utilities (if any) affected by required work. Keep all active utilities intact and in continuous operation.

3.4 PROTECTION

A. Utilities: Locate, identify, and protect utilities located by utilities and indicated in the Drawings to remain from damage.

B. Survey control: Protect bench marks, survey control points, and existing structures from damage or displacement.

C. Preservation and Trimming of Trees, Shrubs and Other Vegetation:

1. Avoid injury to trees, shrubs, vines, plants, grasses and other vegetation growing outside of the areas to be cleared and grubbed and those trees and shrubs designated to be preserved.

2. Protect existing trees and shrubs against cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of roots by stockpiling construction materials, excavated materials, excess foot or vehicular traffic and parking of vehicles within drip line.

3. Provide temporary guards, as necessary, to protect trees and vegetation to be left standing.

4. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

5. Provide protection for roots and limbs over 1 1/2-inch diameter cut during construction operations. Coat cut faces with emulsified asphalt.

6. Repairable damage to trees and shrubs designated to remain shall be made by a professional tree surgeon approved by the Engineer. Cost shall be borne by the Contractor.

D. Landscaped Areas:

1. When any portion of the Work crosses private property or landscaped areas, excavate topsoil separately and pile it on the opposite side of the trench from the subsoil.

2. Conduct Work in a manner that will restore original conditions as nearly as practicable.

3. Remove and replace any trees, shrubs, plants, sod or other vegetative material as needed to complete Work.

4. All shrubs or plants shall be balled by experienced workers, carefully handled and watered, and replaced in their original positions without damage. Sod shall be handled in a similar manner.

5. Wherever sod cannot be saved and restored, the ground must be reseeded and cared for until a stand of grass is reestablished.

6. Plants or shrubs killed or destroyed shall be replaced and paid for by the Contractor.

7. It is the intent of this paragraph that the Contractor shall leave the surface and plantings in substantially the same conditions as before the Work is undertaken.

E. Miscellaneous Site Features: Protect all existing miscellaneous site features from damage by excavating equipment and vehicular traffic, including but not limited to existing structures, fences, mailboxes, sidewalks, paving, and curbs.

F. Repair and Replacement:

1. Damaged items, including but not restricted to those noted above, shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of work of this contract.

2. Any damage to existing facilities or utilities to remain as caused by the Contractor's operations shall be repaired at the Contractor's expense.

3.5 LIMITS

A. As follows, but not to extend beyond Limits of Disturbance:

1. Excavation: 5 feet beyond top of cut slopes.

2. Trench Excavation: 6 feet from trench centerline, regardless of actual trench width.

3. Fill:

a. Clearing and Grubbing: 5 feet beyond toe of permanent fill.
b. Stripping: 2 feet beyond toe of permanent fill.

4. Structures: 15 feet outside of new structures.

5. Roadways: Clearing, grubbing, scalping, and stripping 5 feet from roadway shoulders.

6. Other Areas: As shown.

B. Remove rubbish, trash, and junk from entire area within the Limits of Disturbance as material is generated. Stockpiling shall not be permitted without written approval of Owner.

3.6 CLEARING AND GRUBBING

A. Clear and grub areas within limits shown in approved Clearing, Grubbing and Stripping Plan.

B. Except in areas to be excavated, all holes resulting from the clearing and grubbing operations shall be backfilled and compacted in accordance with the applicable sections of these Specifications.

C. Clearing:

1. Remove trees, saplings, snags, stumps, shrubs, brush, vines, grasses, weeds and other vegetative growth within the clearing limits shown in the Drawings, except those trees and shrubs noted to remain in the Drawings or as directed by the Engineer.

2. Clearing shall be performed in such a manner as to remove all evidence of the presence of vegetative growth from the surface of the project site and shall be inclusive of sticks and branches of thickness or diameter greater than 3/8-inch and of grasses, weeds, exceeding 12 inches in height except as otherwise indicated.

3. Clear undergrowth and deadwood, without disturbing subsoil.

D. Grubbing: Clear areas required for access to site and execution of Work and remove all stumps, root wads, and roots over 1/2-inch diameter to the following depths:

1. 12 to 18 inches.

3.7 TREE REMOVAL

A. Exercise care in cutting, felling, trimming, and handling of those trees shown for removal to prevent damage to neighboring trees and structures to remain.

B. Tree Salvage: As shown on the Plans.

C. No trees may be removed unless approved and permitted by the Engineer.

D. Do not top trees unless otherwise specified or approved by Owner in writing.

3.8 REMOVAL AND DISPOSAL

A. Native vegetation may be mulched and used on Site.

B. Asphalt and Gravel Surfaces:

1. Asphalt, concrete, and gravel surfaces designated for removal shall be done to full depth.

2. Asphalt, concrete, and gravel removed at Site may be reused at Site where shown in the Drawings or following approval of the Engineer.

3. Haul removed asphalt, concrete, and gravel which is unsuitable for reuse or that exceeds quantity required.

C. Remove debris, rock, abandoned piping and extracted plant life from Site.

D. Remove from the Site all debris, materials, equipment and items found thereon and materials and debris resulting from the Work, except as otherwise indicated.

1. All existing improvements designated on the Drawings or specified to be removed including but not limited to structures, pipelines, walls, footings, foundations, slabs, pavements, curbs, fencing and similar structures occurring above, at, or below existing ground surface shall be included in the Work.

2. Unless otherwise specified, any resulting voids shall be thoroughly cracked out for drainage and backfilled with suitable excavated or imported material compacted to the density of the adjacent soil.

E. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

F. Do not burn or bury materials on site. Leave site in clean condition.

G. Removal: All material resulting from demolition, clearing and grubbing, and trimming operations shall be removed from the Site and disposed of in a lawful manner. Materials placed on property of private property owners shall be by written permission only.

H. Cleanup: During and upon completion of work, promptly remove all unused tools and equipment, surplus materials and debris.

I. Adjacent areas shall be returned to their existing condition prior to the start of Work.

3.9 CLEANUP

A. During the time Work is in progress, make every effort to maintain the Site in a neat and orderly condition.

B. All refuse, broken pipe, excess fill material, cribbing and debris shall be removed as soon as practicable.

C. Should the Work not be maintained in a satisfactory condition, the Owner may cause the work to stop until the cleanup of the Work has been done to the satisfaction of the Engineer.

D. The Work will not be considered complete or the final payment certificate issued until all rubbish, unused material, or equipment shall have been removed and the premises left in a condition satisfactory to the Owner and the Engineer.

END OF SECTION

SECTION 31 22 13

ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes rough grading and filling associated with contouring of Site in preparation for building excavation and subsequent site work.

B. Section Includes:

1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, grading, filling, and rough contouring of Site.

1.2 RELATED SECTIONS:

A. Section 01 45 00 - Quality Control
B. Section 31 05 13 - Soils for Earthwork.
C. Section 31 05 16 - Aggregates for Earthwork.
D. Section 31 10 00, Site Clearing.
E. Section 31 23 16 - Excavation.
F. Section 31 23 17 - Trenching.
G. Section 31 23 23 - Fill.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

B. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

3. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

4. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).

5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Soils for Earthwork: As specified in Section 31 05 13, Soils for Earthwork.
C. Aggregates for Earthwork: As specified in Section 31 05 16, Aggregates for Earthwork.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.

PART 2 PRODUCTS

2.1 MATERIALS

A. Subsoil Fill: Type S1 or S2 as specified in Section 31 05 13, Soils for Earthwork.

B. Topsoil: As specified in Section 31 05 13, Soils for Earthwork.

1. Type TS1, Select Native Topsoil Material, as may be available.
2. TS2, Imported Topsoil Material, as may be required.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call Local Utility Line Information service at Washington 1-800-424-5555 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Notify Engineer of any potential conflicts resulting from utility locations and the Drawings.

3. Notify utility company to remove and relocate utilities, as may be necessary.

B. Identify required lines, levels, contours, and datum.

C. See Section 31 10 00, Site Clearing for additional requirements in protection of existing utilities, survey control, plant life and landscaped areas in coordination with the Work of this Section.

3.3 TOPSOIL EXCAVATION

A. Excavate and stockpile topsoil as specified in Section 31 15 13, Soils for Earthwork.

3.4 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded as shown in the Drawings.

B. When practical, do not excavate wet subsoil. When wet subsoil must be excavated, and is to be reused on site for the Work, process wet material to obtain optimum moisture content.

C. Stockpile excavated material in area designated onsite in accordance with Section 31 05 13, Soils for Earthwork.

D. When excavating through roots, perform Work by hand and cut roots with sharp axe.

E. Benching Slopes: Horizontally bench existing slopes greater than 5H:1V to key placed fill material to slope to provide firm bearing.

F. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 FILLING

A. General:

1. Grading and filling operations shall not take place when weather conditions and moisture content of fill materials prevent the attainment of specified density.

2. Vertical curves or roundings at abrupt changes in slope shall be established as approved by Engineer.

3. Bring all graded areas to a relatively smooth, even grade and slope by blading or dragging. Remove high spots and fill depressions.

B. Fill areas to contours and elevations shown in the Drawings with unfrozen materials.

C. Topsoil Fill:

1. Scarify prepared subgrade to depth of 4 inches immediately prior to placing topsoil.

2. Place topsoil in areas to be seeded to depths indicated in the Drawings, minimum depth of 6 inches.

3. Place topsoil material loose; do not compact, do not place in wet or muddy conditions.

D. Place material in continuous layers as follows:

1. Subsoil Fill: Maximum 8 inches compacted depth.
2. Structural Fill: Maximum 12 inches compacted depth.
3. Granular Fill: Maximum 12 inches compacted depth.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Slope grade away from building minimum 2 percent slope for minimum distance of 10 feet, unless noted otherwise.

G. Make grade changes gradual. Blend slope into level areas.

H. Repair or replace items indicated in the Drawings to remain which are damaged by excavation or filling. All costs shall be borne by the Contractor.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 of a foot from required elevation.

3.7 FIELD QUALITY CONTROL

A. Perform laboratory material tests in accordance with ASTM D698 (AASHTO T99).

B. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D2922.
2. Moisture Tests: ASTM D3017.

C. Frequency and location of testing is dependent upon type of material placed. See Section 01 45 00, Quality Control for testing requirements.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at the sole expense of the Contractor.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes excavation required for building foundations, site structures, or under slabs-on-grade or paving. Excavating for utilities outside building is included in Section 31 23 17, Trenching.

B. Section Includes:

1. Excavating for building foundations.
2. Excavating for paving, roads, and parking areas.
3. Excavating for slabs-on-grade.
4. Excavating for site structures.
5. Excavating for landscaping.

1.2 RELATED SECTIONS

1. Section 01 45 00 - Quality Control.
2. Section 31 05 13 - Soils for Earthwork.
3. Section 31 05 16 - Aggregates for Earthwork.
4. Section 31 10 00 - Site Clearing.
5. Section 31 22 13 - Rough Grading.
6. Section 31 23 17 - Trenching.
7. Section 31 23 19 - Dewatering.
8. Section 31 23 23 - Fill.
9. Section 33 11 10 - Water Utility Distribution Piping.
10. Supplemental Information: Geotechnical report; test pit locations and findings of subsurface materials.

1.3 DEFINITIONS

A. Common Excavation: All excavation required for Work, regardless of the type, character, composition or condition of the material encountered. Common Excavation shall further include all debris, junk, broken concrete, and all other material. All excavation shall be classified as Common Excavation.

B. Common Material: All soils, aggregate, debris, junk, broken concrete, and miscellaneous material encountered in Common Excavation, excluding rock as defined below.

C. Concrete Excavation: The removal of pieces of concrete larger than 1 cubic yard in volume that requires drilling, splitting and breaking methods, or a necessitating a

trench width increase of 18 inches or more than the width of the preceding 10 feet of trench. Concrete excavation includes materials composed of Portland cement that are not identified other than manholes, structures, sewer pipe, or other appurtenances.

D. Exploratory Excavation: The removal and replacement of material from locations shown on the Drawings, or as directed for the purpose of investigating underground conditions and identifying potential utility conflict between existing and proposed utilities.

E. Overbreak: Material beyond and outside of the slope limits established by the Owner's Representative, which becomes displaced or loosened during excavation and is excavated.

F. Pothole Excavation: Pothole excavation is the removal and replacement of all materials via coring, vacuum extraction, or similar method, not classified as exploratory excavation, for the purposes of locating an underground utility and to investigate underground conditions.

G. Spoils: Excavated materials from Site unsuitable for use as fill or not required for backfill and grading.

H. Unsuitable Materials: See Spoils.

1.4 REFERENCES

A. Local utility standards when working within 24 inches of utility lines.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: At a minimum, to include the following:

1. Methods and sequencing of mass excavation.

2. Proposed onsite and off-site spoil disposal locations.

3. Anticipated difficulties and proposed resolutions.

4. Proposed routes for Owner's access to Owner's facilities impacted by excavation Work.

5. Proposed haul routes.

1.6 QUALITY ASSURANCE

A. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

B. Provide adequate survey control to avoid unauthorized over excavation.

C. Weather Limitations:

1. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws.

2. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Prior to commencing work in this Section, become familiar with site conditions. In the event discrepancies are found, notify the Engineer as to the nature and extent of the differing conditions.

B. Call Local Utility Line Information service at Washington 1-800-424-5555 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Coordinate with and notify utility companies should it be necessary to remove or relocate facilities.

C. Identify required lines, levels, contours, and datum.

D. See Section 31 10 00, Site Clearing for additional requirements in protection of existing utilities, survey control, plant life and landscaped areas in coordination with Work in this Section.

3.2 SITE CONDITIONS

A. Quantity Survey: The Contractor shall be responsible for calculations for quantities and volume of cut and fill from existing site grades to finish grades established under this contract as indicated in the Drawings or specified and shall include the cost for all earthwork in the total basic bid.

B. Dust Control: Must meet all federal, state and local requirements. Protect persons and property from damage and discomfort caused by dust. Water surfaces as necessary and when directed by Engineer to quell dust.

C. Soil Control: Soil shall not be permitted to accumulate on surrounding streets or sidewalks nor to be washed into sewers.

3.3 EXISTING UNDERGROUND UTILITIES

A. Protect active utilities encountered, located or otherwise, and notify persons or agencies owning same.

B. Remove inactive or abandoned utilities from within the project grading limits in accordance with Section 33 11 50, Existing Pipe Abandonment.

C. For sewer and other miscellaneous drainage facilities, fill and plug pipes as follows:

1. General:

   a. Remove all structures to a minimum of 3 feet below subgrade, unless otherwise noted.

   b. Cover top surface of all abandoned structures with two sheets of nonwoven geotextile, extended at least 1 foot beyond the outside walls of the abandoned manhole, sump, or basin.

   c. Plug all abandoned pipes with permanent plugs as specified in Section 33 11 50, Existing Pipe Abandonment.

2. Sumps:

   a. Remove existing sediment, soil, and water. Properly dispose of these materials in accordance with the requirements of these specifications.

   b. Remove top cone and first solid concrete section to a depth of approximately 8 to 10 feet below ground.

   c. Fill sump with CLSM.

   d. Backfill remaining voids for facilities within existing or proposed roadways with approved materials meeting the requirements of Section 32 11 23, Aggregate Base Courses.

3. Salvaging Manhole Frames, Covers, and Grates:

   a. Remove manhole frames, covers, and grates scheduled for salvage and store in approved location.

   b. Frames, grates, and covers meeting Specifications may be salvaged from structures to be adjusted and may be reused in the Work if of suitable size and condition.

   c. Replace, at no additional cost to the Owner, all items damaged or lost by the Contractor with similar items that are comparable in all respects with those they are to replace, and which are adequate for the intended purpose.

d. Clean salvaged components to be reused of foreign material by methods that will not harm the components.

4. Existing Manhole Frames and Covers: Manhole frames and covers removed by the Contractor are the property of the Owner. Notify the Engineer a minimum of 48 hours before removal to arrange for pickup of the removed frames and covers, if not reused.

3.4 PRESERVATION OF EXISTING IMPROVEMENTS

A. Protect adjacent existing structures which may be damaged by excavation work.

1. Conduct operations in such a manner that existing street facilities, utilities, railroad tracks, structures, and other improvements, which are to remain in place, will not be damaged. Furnish and install cribbing and shoring or whatever means necessary to support material around existing facilities, or to support the facilities themselves, and maintain such supports until no longer needed.

2. Open slopes shall not be cut within 5 feet of any existing spread footings unless approved by the Engineer.

3. Do not interfere with 45 degree bearing splay of foundations unless approved by the Engineer

4. Excavated material shall not be placed adjacent to existing or proposed structures.

3.5 EXCAVATION

A. General:

1. Method of excavation shall be the Contractor's option, but care shall be exercised as final grade is approached to leave it in undisturbed condition.

2. If the final grade for supporting structures is disturbed, it shall be restored to requirements of these Specifications and satisfaction of the Engineer at no additional cost to Owner.

3. The Contractor is advised that footings should be poured as soon as possible to minimize unfavorable final grade conditions from developing.

4. Provide all measures to ensure public safety.

B. Control of Water:

1. Provide and maintain equipment to remove and dispose of water during the course of the work of this Section and keep excavations dry and free of frost or ice.

2. Bearing surfaces that become softened by water or frost must be re-excavated to solid bearing at Contractor's expense and backfilled with compacted crushed rock at Contractor's expense.

3. Grade top perimeter of excavation to prevent surface water from draining into excavation.

4. See additional requirements in Section 31 23 19, Dewatering.

C. Frozen Ground: Frost protection shall be provided for all structural excavation work. Foundation work shall not be placed on frozen ground.

D. Excavate material of every nature and description to the lines and grades as indicated in the Drawings and/or as required for construction of the facility.

1. Allow for forms, shoring, working space, granular base, topsoil and similar items, wherever applicable.

2. Trim excavations to neat lines. Remove loose matter and lumped subsoil.

E. Excavated Materials: Soils excavated at Site will be treated and used as one of two general categories of material as provided below.

1. Fill:

a. Subsoil Type S1, Select Native Fill, as approved for use by Engineer.

2. Spoils:

a. Ensure there is sufficient suitable material available to complete embankments and other required fillings prior to disposing of any excavated materials.

b. Make arrangements for disposal of spoils and include as part of contract work in preparing of project bids.

c. Landfill permit or written permission from private property owner to be obtained by the Contractor and provided to the Engineer.

F. Shoring:

1. The Contractor shall be solely responsible for excavation protection and worker safety and shall provide sheeting and shoring wherever required, all in accordance with current local, state and federal laws, codes and ordinances.

2. Where shoring, sheet piling, sheeting, bracing, lagging, or other supports are necessary to prevent cave-ins or damage to existing structures, it shall be the responsibility of the Contractor to design, furnish, place, maintain and remove such supports in accordance with applicable ordinances and safety requirements.

3. The design, planning, installation and removal of all sheeting, accomplished in such a manner as to maintain the undisturbed state of the soil below and adjacent to the excavation.

G. Slope existing banks with machine to angle of repose or less until shored.

1. Shape, trim, and finish cut slopes to conform to lines, grades, and cross-sections shown, with proper allowance for topsoil or slope protection, where shown.

2. Protection of excavation side slopes:

a. Use excavation methods that will not shatter or loosen excavation slopes.

b. Where practical, excavate materials without previous loosening and in limited layers or thickness to avoid breaking the material back of the established slope line.

c. Avoid overbreaks. Overbreak is incidental to the Work, except in cases where the Owner's Representative determines that such overbreak was unavoidable.

d. Excavation in rock or rocky cuts:

1) Once completed, thoroughly test the slopes with bars or other approved means to remove all loose, detached, broken, or otherwise unstable material.

2) Remove jutting points. Scale slopes using mine scaling rods or other approved methods to remove loose or overhanging materials and provide a safe, trim, neat, and stable condition.

3) Dispose of the materials removed under this subparagraph in the same manner as other excavated material.

e. Remove all exposed roots, debris, and all stones more than 3 inches in size which are loose or could become loosened.

3. Construct slopes free of all exposed roots.

4. Construct slopes free of unstable rock and loose stones exceeding 3 inches in diameter.

5. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend off-site, outside of easements, outside of rights-of-way, or adversely impacts existing facilities, adjacent property, or completed Work.

6. Trim all surfaces neatly and smoothly.

H. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 17, Trenching and Section 31 23 23, Fill.

I. Notify Engineer of unexpected subsurface conditions.

J. Overexcavation for Unsuitable Foundation Conditions:

1. Cross-sectional dimensions and depths of excavations shown in the Drawings shall be subject to such changes as may be found necessary by the Engineer to secure foundations free from soft, weathered, shattered and loose material or other objectionable materials.

2. Unsuitable materials encountered shall be removed and replaced with Gravel Backfill for Foundations, Class A. All material placed shall be compacted to 95 percent of maximum dry density.

3. Unsuitable materials shall be removed and replaced only as directed in writing by Engineer.

K. Rock Removal:

1. Remove boulders and rock up to 1/2 cubic yard measured by volume per the requirements of this Section.

2. Concrete removal, as defined herein, shall be treated as Rock Removal.

L. Stockpile excavated material in area(s) designated on or off site in accordance with Section 31 05 13, Soils for Earthwork.

3.6 FIELD QUALITY CONTROL

A. Perform excavation and controlled fill operations in accordance with the requirements of this Section.

B. Coordinate the visual inspection and approval of all bearing surfaces by Engineer before installing subsequent work.

3.7 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability and store excavated materials at a distance from top of excavation.

B. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 31 23 17

TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the requirements for excavation and backfill of all utilities, including installation of pipe bedding, pipe zone backfill, and trench backfill and related Work as shown on the Drawings and as specified.

B. Section includes:

1. Excavating trenches for pipe, utility vaults and other utilities.
2. Compacted fill from top of utility bedding to final grades.
3. Trench and utility vault backfilling and compaction.

C. Related Sections

1. Section 01 45 00 - Quality Control.
2. Section 03 11 00 - Concrete Work.
3. Section 31 05 13 - Soils for Earthwork.
4. Section 31 05 16 - Aggregates for Earthwork.
5. Section 31 10 00 - Site Clearing.
6. Section 31 22 13 - Rough Grading.
7. Section 31 23 16 - Excavation.
8. Section 31 23 23 - Fill.
9. Section 31 37 00 – Rip Rap.
10. Section 33 11 10 - Water Utility Distribution Piping.
11. Supplemental Information: Geotechnical report; test pit locations and findings of subsurface materials.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

B. ASTM International:

1. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

5. D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

1.3 DEFINITIONS

A. Controlled Low Strength Material (CLSM): Also referred to as Flowable Fill. Lean cement concrete fill. A self-compacting, cementitious material.

B. Flexible Pipe: For the purposes of these Specifications, tubing between ½-inch and 4-inch diameter constructed of polyvinyl chloride (PVC) and high-density polyethylene (HDPE) are considered flexible pipes. HDPE piping 4 inches in diameter and larger is also considered flexible pipe.

C. Foundation Zone: Removal of unsuitable material in the bottom of a trench and replacement with specified material for support of a pipe, main, conduit, structure, or appurtenances. Backfill with imported granular material consisting of gravel or crushed rock meeting the requirements of this Section and Coarse Aggregate Type A3 or Type A4 as specified in Section 31 05 16, Aggregates for Earthwork.

D. Geosynthetics: Geotextiles, geogrids, geomembranes, and drainage composite materials.

E. Imported Material: Materials obtained from sources offsite, suitable for specified use.

F. Lift: Loose (uncompacted) layer of material.

G. Obstructions: Items which may be encountered during utility and vault trenching which do not require replacement.

H. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.

2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

I. Pipe Zone: Trench backfill zone for full trench width which extends from four inches below the bottom outside surface of pipe, conduit, cable or duct bank to the trench foundation so as to uniformly support the barrel of the pipe to a minimum of 12 inches above the top outside surface of pipe, conduit, cable or duct bank.

J. Pipe Zone and Trench Backfill Classifications:

1. Class A: Backfill with suitable native or imported material that is approved to meet the characteristics required for the specific surface loading or other criteria of the backfill zone.

2. Class B: Backfill with imported granular material consisting of gravel or crushed rock meeting the requirements of this Section and Coarse Aggregate Type A4 as specified in Section 31 05 16, Aggregates for Earthwork.

3. Class C: Backfill with Sand, as specified in Section 31 05 16, Aggregates for Earthwork.

4. Class D: Backfill with approved pit run or bar run material, well-graded from coarse to fine; maximum dimension shall be 3 inches.

5. Class E: Backfill with CLSM. See WSDOT Standard 2-09.3(1)E.

6. Class F: Backfill with imported granular material consisting of gravel or crushed rock meeting the requirements of this Section and Coarse Aggregate Type A1 as specified in Section 31 05 16, Aggregates for Earthwork.

K. Pothole Excavations: Removal and replacement of all materials via coring, vacuum extraction, or similar method for the purposes of locating an underground utility and to investigate underground conditions.

L. Prepared Trench Bottom: The bottom of the trench on which the pipe bedding is to lie and which provides support for the pipe.

M. Relative Compaction: Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM Standards.

N. Rigid Pipe: For the purposes of these Specifications, pipe constructed of PVC, ductile iron, steel, concrete and clay pipes are considered rigid pipes.

O. Sewer, Pipes, and Mains: Conduits of circular or other geometric shapes, used to convey liquids or gases, or other material.

P. Trench Backfill Zone: Trench backfill zone for full trench width extending from the top of the pipe zone to the bottom of the trench surfacing zone.

Q. Trench Surfacing Zone: Trench backfill zone for full trench width extending from the top of the trench backfill zone to the surface.

R. Utility: Any buried pipe, duct, conduit, or cable.

S. Well-Graded: A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

1.4 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: At a minimum, to include the following:

1. Methods and sequencing of mass excavation.

2. Proposed on-site and off-site spoil disposal locations.

3. Anticipated difficulties and proposed resolutions.

4. Proposed routes for Owner’s access to Owner’s facilities impacted by excavation Work.

5. Proposed haul routes.

C. Product Data:

1. Geotextile fabric, indicating fabric and construction.
2. Marking tapes;
3. Tracer wire;
4. Connectors for tracer wire and/or marking tapes;
5. Tracer wire locate boxes;
6. Ground wires

D. Imported Materials:

1. Materials Source: Submit name and location of imported fill materials suppliers.

2. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

3. Submit results of aggregate sieve analysis and standard proctor test for granular material.

E. CLSM: Mix designs in accordance with Submittal requirements of WSDOT Standard 2-09.3(1)E..

F. Concrete: Mix designs in accordance with Submittal requirements of Section 03 11 00, Concrete Work.

1.5 QUALITY ASSURANCE

A. Subsoil and topsoil fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 13, Soils for Earthwork.

B. Aggregate fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 16, Aggregates for Earthwork.

C. CLSM:

1. In-place testing: In accordance with ASTM C403.
2. Compressive testing: In accordance with ASTM D4832.

D. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

1.6 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

B. Coordinate trenching and utility installation work with other work at utility construction location occurring near or adjacent to specified herein.

PART 2 PRODUCTS

2.1 BACKFILL MATERIALS

A. Subsoil Fill: Type S1, Select Native Material as specified in Section 31 05 13, Soils for Earthwork.

B. Imported Granular Fill: Coarse Aggregate Type A1, Crushed Surfacing with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

C. Concrete:

1. Lean concrete as specified in WSDOT Standard 2-09.3(1)E, with compressive strength of 100 psi.

2. Structural concrete as specified in Section 03 11 00, Concrete Work with compressive strength of 3,000 psi.

D. Drain Rock: Coarse Aggregate Type A2, Granular Drain Backfill Material with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

E. Sand: As specified in Section 31 05 16, Aggregates for Earthwork.

F. Foundation Stabilization Material: Foundation material Class A and Class B conforming to the requirements of WSDOT Standard 9-03.17.

2.2 MARKING TAPE

A. Detectable:

1. Solid aluminum foil, visible on unprinted side, encased in protective high visibility, inert polyethylene plastic jacket.

2. Foil Thickness: Minimum 0.35 mils.

3. Laminate Thickness: Minimum 5 mils.

4. Width: 6 inches.

5. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.

6. Joining Clips: Tin or nickel-coated furnished by tape manufacturer.

7. Manufacturers and Products:

a. Reef Industries; Terra Tape, Sentry Line Detectable.
b. Mutual Industries; Detectable Tape.
c. Presco; Detectable Tape.

B. Color: In accordance with APWA Uniform Color Code for Temporary Marking of Underground Facilities and as specified in NEMA Z535.1, Safety Color Code.

Color	Facility
Red	Electric power lines, cables, conduit, and lightning cables
Orange	Communicating alarm or signal lines, cables, or conduit
Yellow	Gas, oil, steam, petroleum, or gaseous materials
Green	Sewers and drain lines
Blue	Potable water
Purple	Reclaimed water, irrigation, and slurry lines

2.3 ELECTRONIC LOCATING MATERIALS

A. Tracer Wire:

1. Direct burial No. 12 AWG solid, annealed copper-clad steel (CCS) high strength tracer wire.

2. Tensile Breaking Load: 380-pound average.

3. Jacket:

    a. High molecular weight high-density polyethylene complying with ASTM D1248, 30-volt rating.

    b. Color: Provide in colors per Article 2.03 B above.

4. Manufacturer and Product: Copperhead Industries; LLC, 12 CCS high strength reinforced tracer wire, or approved equal.

B. Tracer Wire Connectors:

1. Waterproof, corrosion proof and suitable for No. 12 AWG solid core wire.

2. Prefilled with silicone and suitable for use with low-voltage tracer lines of less than 50 volts.

3. Lug Connectors:

    a. Waterproof plastic housing that encases the silicone prefilled lug terminals.
    b. Manufacturer and Product: King Innovations; DryConnTM Direct Bury Lug, or approved equal.

4. Twist Connectors:

    a. Waterproof epoxy-filled packaging that encases the silicone prefilled twist connectors.

    b. Manufacturer and Product: 3M Division; DBY Direct Bury Splice Kit 09053 connectors, or approved equal.

C. Ground Wire: No. 12 AWG bare solid copper wire.

D. Locator Station:

1. Test Station:

    a. Lexan® polycarbonate.
    b. Color: Provide in colors per Article 2.03 B above.

2. Terminals suitable for No. 12 AWG leads.

3. Use single (two lead) locator stations with two terminals, one for ground wire and one for tracer wire, when only one tracer wire is terminated in manhole.

4. Use multilead locator stations with the appropriate number of terminals when 2 or more tracer wire leads are terminated in manhole.

5. Manufacturer and Product: Cott Manufacturing Company; FlangeFink® Cathodic Protection Test Station.

PART 3 EXECUTION

3.1 PREPARATION

A. Call Local Utility Line Information service at Washington 1-800-424-5555 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Coordinate with and notify utility companies should it be necessary to remove or relocate facilities.

3. Maintain and protect above and below grade utilities indicated to remain.

B. Identify required lines, levels, contours, and datum locations.

C. Drawings and/or specifications cover and govern replacement and restoration of foreseeable damage.

D. The site of an open cut excavation shall be first cleared of all obstructions preparatory to excavation in accordance with Section 31 10 00, Site Clearing.

E. See Section 31 10 00, Site Clearing for additional requirements in protection of existing utilities, survey control, plant life and landscaped areas in coordination with Work in this Section.

1. Intent of Drawings and Specifications is that all streets, structures, and utilities be left in condition equal to or better than original condition.

2. Where damage occurs, and cannot be repaired or replaced, the Contractor shall purchase and install new material, which is satisfactory to Owner.

F. Potholing / Exploratory Test Pits: Dig such exploratory test pits and perform potholing as may be necessary in advance of trenching to determine the exact location and elevation of subsurface structures, pipelines, duct banks, conduits, and other obstructions which are likely to be encountered or need to be connected to and shall make acceptable provision for their protection, support, and maintenance of their continued operation.

G. Paved or Surfaced Streets:

1. Wherever paved or surfaced streets are cut, saw wheel or approved cutting devices shall be used.

2. Width of pavement cut shall be as shown in the Drawings.

3. Any cut or broken pavement shall be removed from site during excavation.

H. Traffic:

1. Maintain street traffic at all times as required by the Drawings and as specified herein.

2. Erect and maintain barricades, warning signs, traffic cones, and other safety devices during construction in accordance with the latest edition of Manual of Uniform Traffic Control Devices (MUTCD), Part 6, to protect the traveling public in any area applicable.

3. Provide flaggers as required during active work in roadway areas.

I. Operations shall be confined to rights-of-way and easements provided. Avoid encroachment on, or damage to, private property or existing utilities unless prior arrangements have been made with copy of said arrangement submitted to Engineer.

3.2 EASEMENTS

A. Where portions of the Work are located on private property, easements and permits will be obtained by the Owner. Easements shall provide for the use of property for construction purposes to the extent indicated on the easements.

B. Copies of these easements and permits will be available from the Owner for inspection by the Contractor. It shall be the Contractor's responsibility to determine the adequacy of the easement obtained in every case.

C. Confine construction operations to within the easement limits or street right-of-way limits, or make special arrangements with the property owners for the additional area required and notify the Engineer with a copy of the written approval from property owners of any such conditions.

D. Any damage to private property, either inside or outside the limits of right-of-way or easements provided by the Owner, resulting from Work shall be the responsibility of the Contractor. Before the Engineer will authorize final payment, the Contractor will be required to furnish the Owner with written releases from property owners where the Contractor has obtained special agreements or easements or where the Contractor's operations, for any reason, have not been kept within the construction right-of-way obtained by the Owner.

3.3 PROTECTION

A. Existing Facilities:

1. It is the intent of these specifications that all streets, structure, and utilities be left in a condition equal to or better than original condition at the completion of the Project.

2. Where damage occurs, and cannot be repaired or replaced, the Contractor shall purchase and install new material to the satisfaction to the Engineer.

3. Drawings and/or specifications cover and govern replacement and restoration of foreseeable damage.

B. Removal of Water:

1. As specified in Section 31 23 19, Dewatering.

2. At all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the Work.

3. Keep all excavations dry until the utilities or vaults to be placed therein are completed. In water bearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation dry as specified.

4. Dispose of water from the Work in a suitable legal manner without damage to adjacent property or structures.

C. Trench Protection:

1. Provide the materials, labor and equipment necessary to protect trenches at all times.

2. Trench protection shall provide safe working conditions in the trench and protect the Work, existing property, utilities, pavement, etc.

3. The method of protection shall be according to the Contractor's design.

4. The Contractor may elect to use a combination of shoring, overbreak, tunneling, boring, sliding trench shields, or other methods of accomplishing the work provided the method meets the approval of all applicable local, state and federal safety codes.

5. Damages resulting from improper shoring, improper removal of shoring or from failure to shore shall be the sole responsibility of the Contractor.

3.4 LINES AND GRADES

A. Trench excavation for piping, utility vaults and other utilities shall be performed to the alignment and grade as indicated in the Drawings.

B. Where grades are not shown in the Drawings, utilities shall be laid to grade between control elevations shown.

C. Water mains shall be installed with a minimum cover of 36 inches.

D. The Engineer reserves right to make changes in lines, grades and depths of utilities when changes are required for Project conditions.

E. Changes in the grade and horizontal alignment of the pipeline as shown in the Drawings or as provided elsewhere in the Specifications may be necessary due to unanticipated interferences or other reasons.

1. No additional compensation will be allowed the Contractor for changes in horizontal alignment.

2. No additional compensation will be allowed for changes in grade which require additional depth of trench excavation and backfill up to 2 feet from those shown in the Drawings.

F. Use laser-beam instrument with qualified operator to establish lines and grades.

3.5 OBSTRUCTIONS

A. Obstructions to the construction of the trench, such as tree roots, stumps, abandoned pilings, abandoned buildings and concrete structures, logs, rubbish, and debris of all types shall be removed without additional compensation from the Owner.

B. The Engineer may, if requested by the Contractor or Owner, make changes in the trench alignment to avoid major obstructions if such alignment changes can be made within the perpetual easement and right-of-way and without adversely affecting the intended function of the facility or increasing costs to the Owner.

3.6 INTERFERING ROADWAYS AND STRUCTURES

A. Remove, replace and/or repair any damage done during trenching activities to fences, buildings, cultivated fields, drainage crossings, and any other properties without additional compensation from the Owner.

1. Replace or repair these structures to a condition as good as or better than their pre-construction condition prior to commencing work in the area.

B. Paved Roadways:

1. Where paved roadways are cut as part of trenching activities, Class D trench backfill will be required to the bottom of pavement base.

2. New pavement shall be equal to or better than the existing paved surface.

3. New surface shall not deviate by more than 1/4-inch from the existing finish elevation.

C. Existing Structures:

1. If existing structures are encountered as part of trenching activities which will prevent construction and are not adequately shown in the Drawings, the Contractor shall notify the Engineer before continuing with the Work.

2. The Engineer may make such field revisions to the utility alignment as necessary to avoid conflict with the existing conditions.

3. The cost of waiting or “down time” during such field revisions shall be borne by the Contractor without additional cost to the Owner or liability to the Engineer.

4. If the Contactor fails to so notify the Engineer when a conflict of this nature is encountered, but proceeds with construction despite this interference, the Contractor shall do so at the Contractor’s own risk with no additional payment.

3.7 TRENCHING

A. Excavate subsoil as required for construction of utilities to elevations shown in the Drawings.

B. Remove boulders and rock up to 1/2 cubic yard measured by volume per the requirements of this Section.

C. Open Trench Limit:

1. Do not advance open trench beyond the distance which will be backfilled and compacted the same day.

2. A maximum length of open trench shall not exceed 100 feet at any one time.

3. Temporary resurfacing shall be completed within 300 feet of the associated open trench limit for each main pipe laying operation.

4. Cover or backfill excavations at the end of each day.

5. If the trench is not backfilled at the end of each working day:

a. Provide means to prevent caving of excavation sides, as necessary, during non-working hours.

b. Cover the excavation with a system as needed to provide public safety and prevention of entry during non-working hours.

c. Provide signed and stamped submittal of caving prevention system and cover system.

6. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe and proper condition.

D. Utility Crossings: Avoid horizontal and vertical conflicts with existing utilities.

1. Perform excavation within 24 inches of existing utility service in accordance with utility's requirements.

2. Vertical clearance between the new pipe and existing utilities shall be 12 inches minimum, unless otherwise noted on the Drawings.

3. Where existing utility lines are damaged or broken during trenching activities, the utility shall be repaired or replaced. For water or sewer bearing lines, care being taken to insure a smooth flow line and absolutely no leakage at the new joints.

4. All expenses involved in the repair or replacement of leaking or broken utility lines that have occurred due to the Contractor's operations shall be borne by the Contractor, and the amount thereof shall be absorbed in the unit prices of its bid.

E. Water Lines Crossing Sewer Lines: Whenever water lines cross sewer lines, the Contractor shall comply with local Health Department requirements.

1. Wherever possible, the bottom of the water line shall be 18 inches or more above the top of sewer pipe. One full length of the water line pipe shall be centered at the crossing.

2. For clearances less than 1.5 feet, the Contractor shall replace the existing sewer pipe with ductile iron or PVC of equal size, centered at the utility crossing, or shall encase existing sewer pipe with concrete for a minimum of 10 feet on both sides of crossing, as directed by the Engineer, at no additional cost to the Owner.

F. Excavate trenches to width and depth as indicated on Drawings. No additional payment will be provided for trenching activities beyond dimensions shown in the Drawings.

1. Excavation for trenches in which pipelines are to be installed shall provide adequate space for workers to place and joint the pipe properly and safely, but in every case the trench shall be kept to a minimum width.

2. The width of the pipe trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench shall not exceed 12 inches on either side of the pipe.

3. Excavation for utility vaults and other structures shall be wide enough to provide 12 inches between the structure surface and the sides of the excavation.

4. For pipe or utility vaults to have bedding material, excavate to a depth of 6 inches below the bottom of the pipe or utility vault or as shown on the Drawings. Care shall be taken not to excavate below depths required.

5. If over digging occurs, the trench bottom shall be filled to grade with compacted bedding material.

G. Remove water or materials that interfere with Work.

1. The trench at all times shall be kept free from water to facilitate fine grading, the proper laying and joining of pipe, and prevention of damage to completed joints.

2. Adequate pumping equipment shall be provided to handle and dispose of the water without damage to adjacent property.

3. Water in the trench shall not be allowed to flow through the pipe while construction work is in progress unless special permission to do so has been given by the Engineer.

4. An adequate screen shall be provided to prevent the entrance of objectionable material into the pipe.

5. Remove and dispose of existing abandoned sewer pipe, structures, and other facilities as necessary to construct the improvements.

   a. Where the excavation activities require the removal of portions of an abandoned pipeline, masonry plugs shall be installed in the open ends of the pipe, unless otherwise noted in the Drawings or by the Engineer.

   b. Coordinate with Engineer prior to plugging.

   c. For plugs less than 36 inches in diameter, 8-inch deep masonry units shall be used. For plugs in larger pipelines, 12-inch deep masonry units shall be used.

6. The costs associated with the removal of water and materials noted above will be considered incidental to trench excavation and backfill.

H. Do not interfere with 45 degree bearing splay of foundations.

I. Overexcavation for Unsuitable Trench Foundation Conditions:

1. Cross-sectional dimensions and depths of excavations shown in the Drawings shall be subject to such changes as may be found necessary by the Engineer to secure foundations free from soft, weathered, shattered and loose material or other objectionable materials.

2. Unsuitable materials shall be removed and replaced only as directed in writing by Engineer.

3. Unsuitable materials encountered shall be removed and replaced with Coarse Aggregate Type A3 or Type A4, as specified in Section 31 05 16, Aggregates for Earthwork. All material placed shall be compacted to 95 percent of maximum dry density.

4. Install nonwoven geotextile under trench stabilization material, over the soft or yielding excavated surface.

a. Install the nonwoven geotextile ahead of placement of the trench stabilization material, continuously along the excavation bottom and centered on the pipe centerline.

b. Use nonwoven geotextile width equal to the pipe diameter plus 2 feet.

c. Place laps or splices in the geotextile in the direction of the pipe laying. Lap adjoining sections of geotextile at least 2 feet or according to manufacturer instructions.

J. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

K. Excavated material shall be placed at locations and in such a manner that it does not create a hazard to pedestrian or vehicular traffic, or interfere with the function of existing drainage facilities or system operation.

L. Remove excess subsoil not intended for reuse from site.

M. Stockpile excavated material in area designated on site in accordance with Section 31 05 13, Soils for Earthwork.

3.8 TUNNELING

A. In lieu of open cut trenching as specified above, the Contractor may utilize tunnel methods for installation of pipe where ground conditions are favorable and such methods will not disturb foundations under curbs, sidewalks and other structures.

1. The Engineer must approve tunneling methods prior to utility installation.

2. Where tunneling is used, payment for the pipe installation will be made for the equivalent trench excavation and backfill as if the open cut method was used. Payment will not be made for surface restoration including pavement, curbs, sidewalks and other surface improvements whose replacement is avoided by the tunneling method.

3.9 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, new and existing structures, and adjacent and neighboring properties and to prevent caving, erosion, settlement, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

D. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

E. Design sheeting and shoring to be removed at completion of excavation work, unless shown otherwise in the Drawings.

F. Construction Sheeting Left in Place:

1. Furnish, install, and leave in place construction sheeting and bracing when specified or when indicated or shown on the Drawings.

2. Construction sheeting and bracing originally intended for temporary installation, placed by the Contractor to protect adjacent and neighboring structures, may be left in place if desired by the Contractor and approved by the Engineer. All such sheeting and bracing left in place shall be included in the cost for excavation.

3. Any construction sheeting and bracing which the Contractor has placed to facilitate its work may be ordered in writing by the Engineer to be left in place. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating an obligation on its part to issue such orders. Failure of the Engineer to order sheeting and bracing left in place shall not relieve the Contractor of its responsibility under the contract.

4. For sheeting and shoring to be left in place as part of the completed Work, cut off minimum 18 inches below finished grade.

3.10 COMPACTION

A. Testing will be required to show specified densities of compacted backfill are being achieved by the Contractor's compaction methods.

B. Moisture Control:

1. Moisture condition backfill material to within 2 percent of optimum moisture content required for compaction throughout each lift of the fill.

2. Add moisture to granular backfill by sprinkling during compaction operation.

3. Compaction by ponding or jetting is not permitted.

C. Compact all materials and areas that are not accessible for in-place density testing, as determined by the Engineer, in place by whatever equipment and method is practicable or specified, and as approved by the Engineer.

1. Perform compaction at such moisture content as is required to produce well-filled, dense, and firm material in place that will show no appreciable deflection or reaction under the compacting equipment.

3.11 BEDDING

A. All utility vaults, potable water pipe 3-inch nominal diameter and over, all steel pipe, all concrete sewer pipe, all plastic pipe, all pipe under existing or future structures or roadways, and any and all utilities at a depth greater than 6 feet shall be laid in pipe bedding material.

B. Unless otherwise noted in the Drawings, pipe or conduit of less than 3-inch diameter, outside structure lines and at a depth of less than 6 feet shall be bedded in native material properly shaped as specified below, all as detailed on the Drawings.

C. Compacted bedding material shall be placed the full width of the excavated trench to a depth as shown on the trench detail included in the Drawings.

1. In lieu of a detail, the depth shall be 6 inches.

D. Spread the bedding smoothly over entire width of trench to the proper grade so that the pipe is uniformly supported along the barrel.

E. Hand grade and compact each lift to provide a firm, unyielding surface along the entire pipe length. For rigid pipe, compact to at least 90 percent relative compaction.

F. Excavate bell holes at each joint to permit proper assembly and inspection of the joint.

G. Check grade and correct irregularities in bedding material.

H. Center pipes horizontally in trench width.

3.12 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Place fill material, with the exception of CLSM, in continuous layers and compact in 6 to 8-inch lifts.

1. Prevent pipe from moving either horizontally or vertically during placement and compaction of pipe zone material.

2. Where trenches are under existing or future structures, paved areas, road shoulders, driveways or sidewalks, or where designated on the Drawings or specified elsewhere in these specifications, the trench backfill shall be Class E or Class F and pipe zone backfill shall be Class B or Class E. Class B and Class F backfill shall be compacted to 95 percent of maximum density at optimum moisture content.

3. Where trenches are outside existing or future structures, paved areas, road shoulders, driveways or sidewalks, or where designated on plans or specified elsewhere, the trench backfill shall be Class A and pipe zone backfill in these areas shall be Class B. For these locations, compaction of Class A backfill shall be to not less than 90 percent of maximum density at optimum moisture content. Class B backfill shall be compacted to not less than 95 percent of maximum density at optimum moisture content.

E. Employ placement method that does not disturb or damage nearby or adjacent foundation perimeter drainage or utilities in trench.

F. Do not use power-driven impact compactors to compact pipe zone material.

G. Backfill Immediately: All trenches and excavations shall be backfilled immediately after pipe or conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible, unless otherwise directed by the Engineer.

H. Under no circumstances shall water be permitted to rise in open trenches after pipe has been placed.

I. Do not allow backfill material to free fall into the trench or allow heavy, sharp pieces of material to be placed as backfill until after at least 2 feet of backfill has been provided over the top of pipe.

J. Use hand compactors for compaction until at least 2 feet of backfill is placed over top of pipe. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by “walking in” and slicing material under haunches with a shovel to ensure that voids are completely filled before placing each succeeding lift.

K. Placement of Sand:

1. Place medium sand in lifts not exceeding 8 inches in uncompacted thickness.

2. Compact each lift to a minimum of 95 percent relative compaction prior to placing succeeding lifts.

L. Placement of CLSM:

1. Discharge from truck-mounted drum-type mixer into trench.

2. Place in lifts not exceeding 2 feet in thickness.

3. No compaction of CLSM is allowed.

4. Use steel plates to protect the CLSM from traffic a minimum of 24 hours. After 24 hours, the CLSM may be paved, or opened to traffic until permanent surface restoration is completed, if it has hardened sufficiently to prevent rutting.

M. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe and proper condition.

N. Do not leave trench open at end of working day.

3.13 MARKING TAPE INSTALLATION

A. Continuously install marking tape along centerline of all buried piping, install 24 inches below finished grade. Coordinate with piping installation drawings.

3.14 ELECTRONIC LOCATING FACILITY INSTALLATION

A. Tracer Wire and Terminal Appurtenances:

1. Tracer Wire:

a. Install as shown or directed directly over the pipe centerline and on top of the pipe zone in all sewer trenches, including mainline sewers, service laterals and storm sewer inlet leads.

b. Connect mainline and service lateral tracer wires using either an approved direct-bury lug connector or direct-bury twist connector.

c. Extend tracer wire to locator stations in manholes, locator boxes, storm inlets, or other visually identifiable terminal appurtenances, allowing for access with electronic locating equipment, as shown or directed and according to the following requirements:

2. Locator Stations:

a. Install locator stations as shown within manholes.

b. Mount locator station to manhole wall within 18 inches of manhole rim with two stainless steel expansion anchors.

c. Drill a minimum 3/8-inch diameter hole through the manhole wall within 18 inches of the finish grade of the manhole rim.

d. Extend the tracer wire from the pipe trench in one continuous piece up the outside of the manhole and through the hole and into a locator station, and attach to one of the lugs in the locator station.

e. When multiple tracer wires are terminated in manhole install a multilead locator station.

f. Extend a ground wire from the locator station through a minimum 3/8-inch diameter hole in the manhole wall.

g. Install ground wire approximately 3 feet deep, and extend from the outside manhole wall a minimum of 3 feet horizontally in any direction.

h. Seal all holes drilled in manhole walls with silicone sealant.

3. Storm Inlet Tracer Wire Termination: Terminate tracer wire inside inlet and directly over storm outlet pipe by placing tracer wire as follows:

a. Drill a minimum 3/8-inch diameter hole through inlet wall to pass tracer wire through to inside inlet wall.

b. Seal hole with silicon sealer or material approved by Engineer.

c. Leave 6 inches of coiled tracer wire along inside of inlet wall approximately 3 inches below the inlet frame and grate or as directed by Engineer.

4. Service Lateral Tracer Wire Termination: Terminate tracer wire at ends of service laterals as shown or directed, as follows:

    a. Termination in Tracer Wire Locate Boxes: Extend the tracer wire in one continuous piece up vertically from the pipe trench and into the bottom of the locate box. Leave 18 inches of coiled tracer wire inside locate box.

    b. Termination at 2-inch by 4-inch Markers: Extend tracer wire in one continuous piece directly up service lateral 2-inch by 4-inch markers and leave 18 inches of tracer wire wrapped around the exposed top end of 2-inch by 4-inch marker.

3.15 VISUAL IDENTIFICATION FACILITIES

A. Tracer Wire Locate Boxes: Install tracer wire locate boxes directly over service laterals at property line, service boundary, or other location as shown or directed by the Engineer.

B. Service Lateral Plastic or Copper Markers:

1. Install plastic or copper markers in the concrete curb directly over the centerline of the service lateral, as shown or directed by the Engineer.

2. Either plastic or copper markers may be used.

3. If there is not suitable concrete curb for marker placement, then install a lateral cleanout as close to property line as practical at location approved by Engineer.

3.16 FIELD QUALITY CONTROL

A. All testing and reporting shall be conducted and completed by the Owner. Initial testing will be paid for by the Owner. Subsequent testing after failure of initial acceptance testing shall be paid by the Contractor.

B. Perform laboratory material tests in accordance with ASTM D698 (AASHTO T99).

C. In-place compaction testing of pipeline backfill materials shall be performed at 2-foot elevation increments, three tests per 200 linear feet of pipeline trench as measured along pipe centerline.

1. The Engineer may reduce the frequency when satisfied with method of compaction.

2. The Engineer may direct testing at a higher frequency at no additional cost to the Owner upon failure to obtain specified densities or if the Contractor changes compaction equipment or methods of compaction.

3. The Engineer shall determine all test locations.

D. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D2922.
2. Moisture Tests: ASTM D3017.

E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at the sole expense of the Contractor.

3.17 SURFACE RESTORATION AND CLEANUP

A. Open Trenches: At the end of each work day, all open trenches shall be backfilled and all trenches within streets shall be temporarily paved or covered to the satisfaction of the Engineer and the local permitting agency.

1. Temporary paving shall be replaced with permanent street paving at the completion of construction within street rights-of-way, or sooner, if deemed necessary by the ENGINEER.

2. No gravel-filled trenches shall be left open within the street right-of-way at the end of the workday.

B. Topsoil:

1. Where trenches cross lawns, garden areas, pastures, cultivated fields, or other areas on which reasonable topsoil conditions exist, remove the topsoil to the specified depth and place the material in a stockpile.

2. Topsoil shall not be mixed with other excavated material.

3. After the trench has been backfilled, the topsoil shall be replaced.

C. Clean up and remove all excess materials, construction materials, debris from construction, etc. Replace or repair any fences, mailboxes, signs, landscaping, or other facilities removed or damaged during construction. Replace all lawns, topsoil, shrubbery, flowers, etc., damaged or removed during construction. The Contractor shall be responsible for seeing that lawns, shrubs, etc. remain alive and leave premises in condition equal to original condition before construction.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes temporary dewatering and surface water control systems for open excavations and utility trenches.

B. Section includes:

1. Dewatering systems.
2. Surface water control systems.
3. System operation and maintenance.
4. Water disposal.

1.2 RELATED SECTIONS

A. Section 02 30 00 - Subsurface Investigations.
B. Section 31 05 16 - Aggregates for Earthwork.
C. Section 31 23 16 - Excavation.
D. Section 31 23 17 - Trenching.

1.3 SUBMITTALS

A. Dewatering Plan:

1. Descriptions of proposed groundwater and surface water control facilities including, but not limited to, equipment; methods; standby equipment and power supply; pollution control facilities; discharge locations to be utilized; and provisions for immediate temporary water supply as required by this Section.

2. Plan to be reviewed by the Engineer prior to the beginning of construction activities requiring dewatering. Review by the Engineer of the design shall not be construed as a detailed analysis of the adequacy of the dewatering system, nor shall any provisions of the above requirements be construed as relieving the Contractor of its overall responsibility and liability for the work.

1.4 DEFINITIONS

A. Dewatering includes the following:

1. Lowering of ground water table and intercepting horizontal water seepage to prevent ground water from entering excavations, trenches, tunnels, and /or shafts.

2. Reducing piezometric pressure within strata to prevent failure or heaving of excavations, trenches, tunnels, and /or shafts.

3. Disposing of removed water.

B. Surface Water Control: Removal of surface water within open excavations.

1.5 QUALITY CONTROL

A. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the Contractor.

B. Provide all labor, materials, and equipment necessary to dewater trench and structure excavations, in accordance with the requirements of the Contract Documents.

C. Secure all necessary permits to complete the requirements of this Section.

D. Control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.

E. Where the critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement which may develop.

1. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the Contractor.

2. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

PART 2 PRODUCTS

2.1 EQUIPMENT

Dewatering, where required, may include the use of well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, and other means. Standby pumping equipment shall be maintained on the jobsite.

PART 3 EXECUTION

3.1 DEWATERING

A. Provide all equipment necessary for dewatering.

1. Have on hand, at all times, sufficient pumping equipment and machinery in good working condition.

2. Have available, at all times, competent workers for the operation of the pumping equipment.

3. Adequate standby equipment shall be kept available at all times to insure efficient dewatering and maintenance of dewatering operation during power failure.

B. Dewatering for structures and pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.

C. Site Grading:

1. At all times, site grading shall promote drainage.

2. Surface runoff shall be diverted from excavations.

3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

E. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with drain rock.

F. Maintain the water level below the bottom of excavation in all work areas where groundwater occurs during excavation construction, backfilling, and up to acceptance.

G. Flotation shall be prevented by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.

H. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.

I. Dispose of water from the work in a suitable manner without damage to the environment or adjacent property. No water shall be drained into work built or under construction without prior consent of the Engineer. Water shall be filtered using an approved method to remove sand and fine sized soil particles before disposal into any drainage system.

J. The release of groundwater to its static level shall be performed 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, pipelines, and sewers.

K. Dewatering of trenches and other excavations shall be considered as incidental to the construction of the work and all costs thereof shall be included in the various contract prices in the bid forms.

END OF SECTION

SECTION 31 23 23

FILL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes backfilling required at building perimeter and site structures to subgrade elevations, fill under interior and exterior slabs-on-grade or pavement, and fill under landscaped areas. Backfilling for utilities within building proper is included within this section; backfilling for utilities outside building is included in Section 31 23 17, Trenching.

B. Section includes:

1. Backfilling building perimeter to subgrade elevations.
2. Backfilling site structures to subgrade elevations.
3. Fill under slabs-on-grade.
4. Fill under paving.
5. Fill for over-excavation.

1.2 RELATED SECTIONS

A. Section 03 11 00 - Concrete Work.

B. Section 31 05 13 - Soils for Earthwork.

C. Section 31 05 16 - Aggregates for Earthwork.

D. Section 31 22 13 - Rough Grading.

E. Section 31 23 16 - Excavation.

F. Section 31 23 17 - Trenching.

G. Section 31 37 00 - Riprap.

H. Section 33 11 10 - Water Utility Distribution Piping.

I. Supplemental Information: Geotechnical report; test pit locations and findings of subsurface materials.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

B. ASTM International:

1. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

5. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

1.4 DEFINITIONS

A. Controlled Low Strength Material (CLSM): Also referred to as Flowable Fill elsewhere in these Specifications. A self-compacted, cementitious material.

B. Imported Material: Materials obtained from sources offsite, suitable for specified use.

C. Lift: Loose (uncompacted) layer of material.

D. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.

2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Imported Materials:

1. Materials Source: Submit name and location of imported fill materials suppliers.

2. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

3. Submit results of aggregate sieve analysis and standard proctor test for granular material.

C. CLSM: Mix designs in accordance with Submittal requirements of Section 01 33 00 - Submittal Procedures.

1.6 QUALITY ASSURANCE

A. Subsoil and topsoil fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 13, Soils for Earthwork.

B. Aggregate fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 16, Aggregates for Earthwork.

C. CLSM:

1. In-place testing: In accordance with ASTM C403.
2. Compressive testing: In accordance with ASTM D4832.

D. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Type S1, Select Native Material, or Type S2, Imported Fill Material, as specified in Section 31 05 13, Soils for Earthwork.

B. Imported Granular Fill: Coarse Aggregate Type A1, Crushed Surfacing with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

C. Concrete:

1. Lean concrete as specified in WSDOT Standard 2-09.3(1)E, Backfilling, with compressive strength of 100 psi.

2. Structural concrete as specified in Section 03 11 00, Concrete Work. Compressive strength as required by the application or as noted in the Drawings.

D. Drain Rock: Coarse Aggregate Type A2, Granular Drain Backfill Material with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

E. Foundation Stabilization Material: Coarse Aggregate Type A3, Granular Foundation Backfill Material as specified in Section 31 05 16, Aggregates for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to Work in this Section, become familiar with Site conditions. In the event discrepancies are found, notify Engineer as to the nature and extent of the differing conditions.

B. Verify sub-drainage, damp-proofing, or waterproofing installation has been inspected.

C. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 SITE CONDITIONS

A. Quantity Survey: The Contractor shall be responsible for calculations for quantities and volume of cut and fill from existing site grades to finish grades established under this contract as indicated in the Drawings or specified and shall include the cost for all earthwork in the total basic bid.

B. Dust Control: Must meet all federal, state and local requirements. Protect persons and property from damage and discomfort caused by dust. Water surfaces as necessary and when directed by Engineer to quell dust.

C. Soil Control: Soil shall not be permitted to accumulate on surrounding streets or sidewalks nor to be washed into sewers.

3.3 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Control of Water:

1. Excavated areas shall be kept free of water and frost.

2. Bearing surfaces which become softened by water or frost shall be re-excavated to solid bearing at Contractor’s expense and backfilled with compacted crushed rock at Contractor’s expense.

3. See Section 31 23 19, Dewatering for additional details.

C. Compact subgrade to density requirements for subsequent backfill materials.

D. Cut out soft areas of subgrade not capable of compaction in place and replace with specified granular fill material. See Article 3.5, Overexcavation for Unsuitable Foundation Conditions in Section 31 23 16, Excavation, for additional details.

E. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

F. Subgrade to be approved by Engineer prior to placement of structures and commencement of backfill activities.

G. Do not allow or cause any work performed or installed to be covered up or enclosed prior to required tests and approvals. Should any Work be enclosed or covered up, uncover at Contractor's expense.

3.4 BACKFILLING

A. Backfill areas to contours and elevations shown in the Drawings with unfrozen materials.

B. Do not place materials when weather conditions and/or moisture content prevent attainment of specified density.

C. Maintain optimum moisture content of backfill materials to attain required compaction density.

D. Employ placement method that does not disturb or damage other work.

E. Mechanical tampers permitted in confined areas.

F. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

G. Foundation Base for Structures:

1. Bring excavation to required subgrade elevation shown in the Drawings.

2. Place foundation base material in 6-inch lifts and compact to 95 percent maximum dry density to required grade shown in the Drawings.

3. Reservoir Foundation:

a. Concrete Footings: Place a 12-inch minimum layer of Coarse Aggregate Type A1, Crushed Surfacing Top Course to required grade under all concrete footings.

b. Concrete Slabs: Place an 8-inch minimum layer of Coarse Aggregate Type A1, Crushed Surfacing Top Course under all concrete slabs.

4. Pump Station:

    a. Concrete Footings: Place a 6-inch minimum layer of Coarse Aggregate Type A1, Crushed Surfacing Top Course to required grade under all concrete footings.

    b. Concrete Slabs: Place an 8-inch minimum layer of Coarse Aggregate Type A1, Crushed Surfacing Top Course under all concrete slabs.

5. Foundations established near finished site grades:

    a. Place a 3-inch thick layer of Coarse Aggregate Type A1, Crushed Surfacing Top Course in the bottom of footing excavations to minimize disturbance of silty foundation soils during wet weather.

    b. Lightly compact material with a light-weight hand-operated vibratory plate compactor.

    c. To provide uniform support, slabs should be underlain by a minimum 8-inch thick granular base course consisting of Crushed Surfacing Base Course or Crushed Surfacing Top Course.

    d. The base course material should be installed in a single lift and compacted to at least 95% of the maximum dry density. See Drawings for details.

H. Backfill for Structures:

1. Prior to placing backfill, remove forms, temporary construction and debris below grade.

2. Backfill shall not be placed against poured concrete until 28 days have passed from completion of original concrete pour, unless otherwise approved by Engineer.

3. Heavy compactors and large pieces of construction equipment shall be kept away from any embedded wall a distance of a least 5 feet in order to avoid the build-up of excessive lateral pressures.

    a. Over-compaction of fill near walls should be avoided.

4. Compaction within 5 feet of the walls shall be accomplished using hand-operated vibratory plate compactors or tamping units.

5. The maximum particle size of granular material placed against buried structures shall be limited to no greater than 1 ½-inch diameter.

6. Structural fill backfill material shall be brought up on all sides of the walls and footings in such a manner as to avoid adverse differential lateral earth pressures on the vertical surfaces.

7. Appropriate lift thickness will depend on the type of compaction equipment used and the type of material being placed. All material shall be compacted to at least 95 percent of the standard maximum dry density.

    a. For moderate- to heavy-weight compactors, a maximum loose lift thickness of 12 inches shall be used.

    b. For hand-operated or small compactors, a maximum loose lift thickness of 8 inches shall be used.

8. Particular care must be taken to avoid damage to the pipe connections to the structure.

9. Utility trench backfill within 10 feet of all structural perimeters shall meet the requirements for structural fill.

10. Compact with vibratory equipment to 95 percent maximum density, unless otherwise specified or shown in the Drawings.

I. For areas receiving surface structures or existing paved areas to be constructed or replaced, such as driveways, parking lots:

1. Place Coarse Aggregate Type A1, Dense-Graded Aggregate, ¾-inch-0 gradation in 6-inch lifts.

2. Compact with vibratory equipment to 95 percent maximum density, unless otherwise specified or shown in the Drawings.

J. Permanent Embankment Fill:

1. On the sloping ground around the reservoir the new embankment fill shall be placed in horizontal lifts on a continuous series of minimum 8-foot wide horizontal benches excavated into the surface of the existing slope.

2. Fill slopes shall be slightly overbuilt and then trimmed back to final grade using a track hoe with a smooth-edged bucket.

3. The Engineer shall review the proposed placement of any fill and evaluate the subgrade prior to fill placement.

4. The proposed compaction equipment shall be approved by the Engineer prior to fill placement to evaluate loads on embedded walls.

5. Permanent embankment fill placed beyond 5 feet of the embedded walls and beneath buildings, pavement, and other structures should be compacted to at least 95% of the maximum dry density.

6. Landscape fill shall be compacted to at least 90% of the maximum dry density as determined by ASTM D 698. Landscape fill should be no steeper then 3H:1V, unless shown otherwise.

K. Slope grade away from building minimum 2 percent slope for minimum distance of 10 feet, unless noted otherwise in the Drawings.

L. Make gradual grade changes. Blend slope into level areas.

M. Remove surplus backfill materials from Site in accordance with Section 31 23 16, Excavation.

3.5 FIELD QUALITY CONTROL

A. All testing and reporting shall be conducted and completed by the Owner. Initial testing will be paid for by the Owner. Subsequent testing after failure of initial acceptance testing shall be paid by the Contractor.

B. Perform laboratory material tests in accordance with ASTM D698 (AASHTO T99).

C. In-place compaction testing for structural fill material shall be performed at 2-foot elevation increments in the fill material with at a minimum of three tests per each 2,500 square feet of material placed, minimum of five tests total. The Engineer shall be provided with the results of each compaction test at the time of testing.

D. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D2922.
2. Moisture Tests: ASTM D3017.

E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at the sole expense of the Contractor.

F. When testing of subgrade is not possible or feasible as detailed above, proof roll compacted fill surfaces under slabs-on-grade, pavers, paving, and as may be otherwise required by the Engineer.

3.6 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 37 00

RIP RAP

PART 1 GENERAL

1.1 SCOPE

This Section consists of furnishing and placing an erosion-resistant cover material for protecting slopes and basins at locations shown or as directed.

1.2 RELATED SECTIONS

A. Section 03 60 00, Grouting.
B. Section 31 22 13, Rough Grading.

1.3 DEFINITIONS

A. Filter Blanket - A layer of graded granular material placed between the area prepared for it and the riprap.

B. Grouted Riprap - Loose riprap with all or part of the spaces filled with Portland cement mortar.

C. Keyed Riprap - Loose riprap placed on prepared slope, riprap geotextile or filter blanket, as specified, and keyed in place by slapping the surface with a piece of armor plating.

D. Loose Riprap - Specified classes of graded rock placed on prepared slope, riprap geotextile or filter blanket, as specified.

E. Riprap Backing - An option of using either riprap geotextile or a filter blanket placed between the area prepared for it and the riprap.

F. Riprap Basin - Energy dissipater consisting of loose riprap placed at pipe outlets as specified.

G. Riprap Geotextile - A geotextile placed between the area prepared for it and the riprap.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Materials Source: Submit name of imported materials suppliers.
C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
D. Results of aggregate sieve analysis and standard proctor tests for all granular material.

PART 2 MATERIALS

2.1 RIPRAP GEOTEXTILE –

A. Furnish riprap geotextile as shown on the Drawings.

2.2 RIPRAP REQUIREMENTS

A. General - Furnish rock for loose riprap meeting the following requirements:

1. Meet the test requirements of provided herein.

2. Be angular in shape. Thickness of a single rock shall not be less than 1/3 its length. Rounded rock will not be accepted unless authorized by the ENGINEER.

3. Meet the gradation requirements for the material specified.

4. Be free from overburden, spoil, shale and organic material. Non-durable rock, shale or rock with shale seams is not acceptable.

B. Gradation Requirements - Grade loose riprap by class and weight of rock according to the following:

1. WSDOT Standard 9-13.1, Riprap and Quarry Spalls.

2. Control Sample - If directed, provide, at a satisfactory location near the project site, a rock sample of at least 5 tons meeting the gradation for the class specified. This sample will be used as a frequent visual reference for judging the gradation of the riprap supplied.

3. Sampling and Testing Assistance - Any difference of opinion between the ENGINEER and the CONTRACTOR shall be resolved by dumping and checking the gradation of two random truckloads of rock. Mechanical equipment, a sorting site and labor needed to assist in checking gradation shall be provided by the CONTRACTOR at no additional cost to the OWNER.

C. Grouted Riprap

1. Furnish rock for grouted rip rap meeting the requirements of stated herein for class and size specified.

2. Furnish non-shrink Portland cement grout meeting the requirements of Section 03 60 00, Grouting.

D. Filter Blanket - Furnish filter blanket material meeting the following requirements according to riprap class:

Riprap Class	Filter Blanket
Quarry Spalls	6-inch layer of Coarse Aggregate Type A1, Crushed Surfacing Top Course meeting the requirements of Section 31 05 16, Aggregates for Earthwork

PART 3 EXECUTION

3.1 PREPARATION

A. Remove brush, trees, stumps and other organic material from slopes to be protected by riprap and dress to a smooth surface.

B. Remove all unsuitable material to the depth shown or directed and replace with approved material.

C. Compact filled areas as specified in Section 31 23 23, Fill.

D. Provide riprap protection as early as the structure foundation construction permits. Prepare the surfaces to be protected as shown.

E. Maintain the trench slopes, riprap geotextile or filter blanket until the riprap is placed.

3.2 RIPRAP GEOTEXTILE

A. Install riprap geotextile as shown in the Drawings or as directed by the ENGINEER.

3.3 FILTER BLANKET CONSTRUCTION

A. If required, place the filter blanket on the prepared area to the full specified thickness in one operation, using methods which will not cause segregation.

B. The surface of the finished layer shall be reasonably even.

3.4 RIPRAP BACKING

A. When indicated on the Drawings, the CONTRACTOR shall have the option of placing either riprap geotextile or a filter blanket behind the riprap.

B. Install the backing per these specifications or as shown in the Drawings.

3.5 RIPRAP

A. General - Unless otherwise directed, place the riprap protection as the embankment is constructed. Its placement shall lag behind embankment construction only as necessary to allow proper embankment construction and prevent mixture of embankment and riprap material.

B. Loose Riprap - Place riprap on the prepared area:

1. With a clam-shell, orange-peel bucket, skip or similar approved device which will contain the riprap material to its final destination. Do not open the bucket until it has been lowered to the slope on which the material is being placed

2. To its full course thickness in one operation

3. According to the compaction requirements of Section 31 23 23, Fill if riprap is placed on geotextile

4. By methods that do not cause segregation of riprap or displace the underlying material

5. To produce a compact riprap protection in which all sizes of material are placed in their proper proportion

6. With some hand placing, or rearranging of individual stones by mechanical equipment, or some other approved means to provide a smooth finished surface

7. Where filter material and/or riprap are placed under water, increase their thicknesses as shown or as directed.

C. Keyed Riprap - After placing loose riprap material, key the riprap into place by slapping the surface with a piece of armor plating (approximately 4 feet x 5 feet in size with a weight of approximately 5,000 pounds) or other approved means which will produce a nearly smooth surface.

D. Grouted Riprap - Place loose riprap material. If the depth specified for grouting is more than 12 inches, place the riprap in lifts of 12 inches or less and grout each lift before placing the next lift. Construct and grout the succeeding lifts before the grout in the previous lift has hardened.

Thoroughly moisten the stones and sluice any excess fines to the underside of the riprap before grouting. Deliver the grout to the place of final deposit by any means that will ensure uniformity and prevent segregation of the grout. Spade or rod the grout into the spaces to completely fill the voids in the riprap. Control pressure grouting and do not unseat the stones. Penetration of the grout shall be to the depth shown on the plans. If a rough surface is specified, brush the stone until 25% to 50% of the depth of

surface stone is exposed. For a smooth surface, grout the crevices to within 5/8-inch of the surface.

Provide weep holes through the riprap as shown or as directed.

Place and cure grout according to 03 60 00, Grouting, except as provided above.

E. Riprap Basins - Excavate, backfill and construct riprap basins, without a riprap geotextile or filter blanket, at pipe outlets with Class 50 riprap as shown or as directed.

3.6 MAINTENANCE

A. Maintain the riprap protection until accepted. Replace any material displaced by any cause at no additional cost to the owner.

END OF SECTION

SECTION 32 12 16.39

ASPHALT PAVING FOR STEEL TANK BASE

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the requirements for placing asphalt concrete pavement under the floor of a new welded steel aboveground water utility storage tank.

1.2 RELATED SECTIONS

A. Section 32 12 16 - Asphalt Concrete Paving.
B. Section 33 16 13.13 - Steel Aboveground Water Utility Storage Tanks.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. As required for asphalt concrete paving per Section 32 12 16, Asphalt Concrete Paving.

PART 2 MATERIALS

2.1 Materials shall comply with the requirements described in section 32 12 16, asphalt concrete paving except as modified herein.

A. Asphalt Cement for the reservoir base shall be HMA class 1/2”, PG 64-22.

PART 3 EXECUTION

3.1 Execution shall comply with the requirements described in section 32 12 16, asphalt concrete paving except as modified herein.

A. A 2-inch thick lift of asphalt concreteshall be placed over a prepared aggregate base and compacted according to WSDOT specifications as shown on the Drawings.

B. When tested with a CONTRACTOR-furnished 10-foot straightedge, the finished surface shall not vary from the testing edge by more than .015 foot and shall be free of all roller marks.

C. The finished asphalt concrete surface shall be flush with the top of the concrete ringwall and sloped at a 2 percent grade to the center point of the tank resulting in a 0.55-foot (6-5/8 inch) crown at tank center.

END OF SECTION

SECTION 32 91 21

FINISH GRADING AND SEEDING

PART 1 GENERAL

1.1 SCOPE

A. This section includes finish grading, erosion control, and establishment of seeding, complete, including furnishing and delivery of labor, materials and equipment.

B. Section Includes:

1. Topsoil.
2. Imported topsoil.
3. Soil conditioners.
4. Fertilizer.
5. Seed mixes.
6. Erosion control matting.
7. Seeding mulch.
8. Tackifier.
9. Guarantee, maintenance and warranty.

1.2 RELATED SECTIONS

A. Section 31 05 13, Soils for Earthwork.
B. Section 32 90 00, Planting.

1.3 SUBMITTALS

A. The following submittals are required as part of this work:

1. Proof of procurement and contract for delivery of plant material.

2. Schedule for delivery of plant material for inspection prior to planting.

3. Sources of plant materials, and identification tags visible for each plant.

4. Color-coded tagging system for all plant material species. (Flag all plant materials prior to installation.)

B. Maintenance Plan: Per the requirements of Section 32 90 00, Planting.

PART 2 MATERIALS

2.1 TOPSOIL

A. Topsoil Type TS1, Select Native Topsoil Material, in accordance with Section 31 05 13, Soils for Earthwork.

2.2 IMPORTED TOPSOIL

A. Topsoil Type TS2, Imported Topsoil Material, in accordance with Section 31 05 13, Soils for Earthwork.

2.3 SOIL CONDITIONERS

A. As described on the Drawings.

2.4 FERTILIZER

A. Slow Release Fertilizer:

1. Slow release fertilizer for use in erosion control seeding containing 22% nitrogen, 16% available phosphoric acid, and 8% potash, including a minimum of 2% sulfur.

2. The fertilizer shall contain not less than 30% available water-insoluble nitrogen derived by incorporating urea formaldehyde.

2.5 SEED MIX

A. As shown in the Plant Schedule in the Drawings.

2.6 EROSION CONTROL SEEDING MULCH

A. Wood or straw mulch processed so that the fibers are uniformly suspended under agitation in water.

B. Blend the mulch with seed, fertilizer, and other typical additives in a hydroseeding mixture to form a homogeneous slurry.

C. The processed mulch shall have the ability to hold grass seed in contact with soil.

D. Fibers shall have moisture-absorption and percolation properties to form a blotter-like cover on the ground.

E. Ship in packages of uniform weight (+/- 5%) and labeled with manufacturer's name and air-dry weight.

2.7 EROSION CONTROL MATTING

A. Jute Matting:

1. Jute matting shall consist of a uniform, open, plain weave of single jute yarn.

2. The yarn shall be of loosely-twisted construction and shall not vary in thickness by more than one-half of its normal diameter.

3. The weave shall provide openings of about 1 square inch.

4. Furnish the matting in widths of 45 inches or more, continuous lengths of not less than 150 feet, and weigh not less than 0.9 pounds per square yard.

B. Staples: 12 gauge or heavier steel wire which is bent to a U-shape 2 inches wide.

C. Excelsior Matting:

1. Consisting of a machine-produced blanket of curled wood fibers, of which 80% are 6-inches or longer.

2. Furnish a blanket of uniform thickness, with the fiber evenly distributed over the entire area of the mat.

3. Matting shall have a minimum dry weight of 0.8 pounds per square yard (+/- 10%). Furnish in a minimum 36-inch wide rolls.

2.8 TACKIFIER

A. Emulsion designed to retain moisture and heat in the soil.
B. Mulch shall be chemically inert, nontoxic to plants, humans, and animals.
C. Tackifier shall be J-Tac, Sentinel Tackifier additive, or equal.

PART 3 EXECUTION

3.1 FINISH GRADING PROCEDURES

A. Mix topsoil with rough grade fill material and mix thoroughly to a depth of 8-inches with soil amendments in the following proportions:

Topsoil	6-inches
Sand	1-inch
Organic Material	1-inch

B. Finish Grading: Spread fill/topsoil material and rake the area to a uniform grade so that all areas drain, as indicated on the Drawings.

C. Preparation of Seedbed: Remove all trash and stones exceeding 2 inches prior to seeding.

3.2 TIME OF SEEDING

A. Conduct seeding operations under favorable weather conditions during seasons which are normal for such work generally from April 1 to June 1, and Sept. 1 to November 1.

B. Guarantee germination of erosion control seeding by November 1 at the latest.

C. Seed all native plant species in fall only.

3.3 EROSION CONTROL MATTING

A. Erosion control matting shall be placed on all slopes with a slope ratio of 2:1 and greater, or as directed by the Engineer.

B. Matting shall be laid flat in single thickness strips paralleling the direction of probable water flow.

C. Multiple strips of matting shall overlap in shingle fashion.

D. Adjacent strips of matting shall be overlapped a minimum of 1-foot, or as recommended by the manufacturer.

E. The erosion matting shall be in contact with the soil at all points and shall be held in place with wire staples, or as recommended by the manufacturer.

F. Anchor the matting in ditches at the top of the slope to ensure it will stay in place.

G. The installation and minimum spacing of wire staples shall be as per manufacturer's specifications.

3.4 SEEDING

A. Seeding operations shall occur in two applications.

1. The first application shall include seed, fertilizer, and mulch.

2. The second application shall consist of tackifier and mulch only and be applied immediately after the first seeding. A second application of fertilizer shall be made two months after initial seeding at the rate indicated below.

B. See Drawings for specified seed mixes. Apply seed mixes per supplier’s recommendations.

END OF SECTION

SECTION 33 01 13.13

REHABILITATION OF STEEL ABOVEGROUND WATER UTILITY STORAGE TANKS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

This Section defines the work required for design, fabrication, and installation of the various appurtenances for the existing ground supported welded steel reservoir. The work described in this Section includes the welded steel reservoir inlet pipe, silt stop, and other appurtenances and accessories. Earthwork, yard piping, landscaping, and provisions for other related project work is covered elsewhere in the specifications.

1.2 QUALIFICATION OF TANK CONTRACTOR

The Contractor's attention is directed to Instructions to Bidders.

1.3 RELATED SECTIONS

A. Section 05 50 00 – Metal Fabrications.
B. Section 09 97 14 – Steel Water Storage Tank Painting

1.4 DESIGN

A. General

The ground supported steel reservoir accessories and appurtenances shall be designed in accordance with the latest edition of the American Water Works Association (AWWA) Standard for Welded Steel Tanks for Water Storage, ANSI/AWWA D100-(latest edition) except as herein modified by these specifications.

B. Design Loads

1. Seismic Loads

All applicable components of the existing ground supported steel reservoirs specified in the Drawings or herein for rehabilitation shall be designed and constructed to resist all seismic forces under both full and empty conditions. Using the effective mass procedure of AWWA D100-(latest edition) Sec. 13.2.4 for Seismic Site Class D, the seismic design factors shall be applied as noted in Sheet S-1 of the Drawings.

Utilize site specific response spectra prepared for this project by GRI Inc. to replace the seismic coefficient in AWWA D100- (latest edition) Sec. 13.2.8. The tank appurtenance design shall be based upon the most conservative value of the site-specific response spectra or the seismic coefficient.

2. Wind Loads

   The reservoir appurtenances shall be designed to resist wind loading under both full and empty conditions. The design method shall be in accordance with the IBC- (latest edition) with the following factors applied:

   Wind Speed = 115 mph; Exposure C; Importance Factor, Iw = 1.15. Minimum wind load shall not be less than 18 pounds per square feet in accordance with AWWA D100.

3. Snow Loads

   Snow loads shall be determined in accordance with the requirements of the latest edition of "Snow Load Analysis for Washington" as published by the Structural Engineers Association (SEAW) of Washington, as modified by SEAW or a local authority. For the site elevation of approximately 316 feet, the uniform ground snow load is 20 pounds per square feet.

C. Codes and Standards

In addition to compliance with the provisions of ANSI/AWWA D100- (latest edition), the reservoir accessories and appurtenances shall be designed and constructed in accordance with all applicable local requirements including the following Codes, Standards:

1. Washington State Building Code, (latest edition).
2. Revised Code of Washington
3. Washington Administrative Code

Details of design and construction shall be such as to allow access to all surfaces for maintenance, cleaning and coating and to eliminate all moisture pockets. All welds shall be "seal" welds. There shall be no open crevices caused by overlap of steel plate on a supporting member.

D. Submittal Requirements

The CONTRACTOR shall provide any and all design drawings required by the ENGINEER to clearly delineate all proposed details of construction. These shall include as a minimum but not be limited to plan, section and elevation views and detail drawings for all proposed accessories and attachments. Detailed structural design calculations shall also be provided, where applicable.

All components, which will be shop fabricated, shall be clearly identified. Shop drawings shall also be provided for all proposed accessories.

Submit manufacturer and model of radiographic weld testing equipment proposed to be used for testing of weld joints; include detailed outline description of equipment operation and testing evaluation methods.

The Contractor shall provide a letter from the reservoir improvement designer, where applicable, who certifies conformance of the design with requirements of these specifications and all applicable codes and standards of the State of Washington. That letter shall include a summary of design data, which identifies live and dead design base loads for wind, snow and seismic loading. The calculated lateral force coefficient shall also be identified. That letter, and the above described design drawings and structural calculations, shall have affixed thereto the current and valid Professional Engineer's seal of an Engineer licensed to practice in the State of Washington unless out-of-state licensing is otherwise approved by the Washington Board of Registration for Professional Engineers and Land Surveyors. The ENGINEER reserves the rights to review and reject with proper cause all or portions of the submittal.

PART 2 MATERIALS

2.1 TANK ACCESSORIES

The completed tank shall include all accessories shown on the drawings and described herein. All accessories shall be designed and constructed in accordance with all applicable Federal, State and local codes and standards.

A. Inlet and Outlet Pipes –

1. Inlet and outlet pipe modifications shall be provided or modified as shown on the Drawings.

2. Water inlet piping shall be four and six inches in diameter as shown on the Drawings.

3. Inlet piping shall be fully supported as shown on the Drawings.

4. All steel piping shall be of extra strong pipe thickness with either flanged ends as per AWWA C207- (latest edition) or plain ends.

5. The steel outlet silt stop shall be shop-fabricated and coated inside and out according to provisions elsewhere in the Contract Documents.

6. The steel portion of the inlet pipe shall be shop-fabricated and coated inside and out according to provisions elsewhere in the Contract Documents.

7. No field welding of pipe sections will be allowed except near ends where pipe can be readily prepared, primed, coated, and inspected without remote equipment.

    a. Where field welds must be made to connect the piping to the tank, the primer and paint shall be held back a minimum of 6 inches with the hold back distances being staggered for each layer of primer/paint.

    b. Upon completion of the pipe connecting welds, the unpainted sections of pipe shall be primed and painted inside and out according to the provisions of this document.

8. All pipe supports and/or other attachments shall be fabricated and welded to pipe sections prior to interior pipe coating.

9. Provisions covered elsewhere in these Contract Documents for piping shall apply to this Section.

PART 3 EXECUTION

3.1 GENERAL

All workmanship required for the improvements of the steel tank structures and all accessories shall be of the highest quality. All work shall conform to the standards set forth in AWWA D100- (latest edition) except as modified herein. The steel tank structure improvements and all integral accessories and components shall be the end product of one manufacturer. The structure improvements shall be constructed to true, plumb and concentric lines and dimensions.

3.2 STANDARDS

All construction shall be in full conformance with all applicable Federal, State, and Local codes, standards and specifications including those set forth by the American Water Works Association (AWWA), Unified Building Code (UBC), American Welding Institute (AWI), the American Institute of Steel Construction (AISC), American Society of Testing Materials, (ASTM) and the Occupational Safety and Health Administration (OSHA).

3.3 IMPROVEMENTS

A. Welding –

1. All welds for the roof retrofit shall be “seal” welds in accordance with the Drawings. All circumferential and longitudinal steel plate shell welds shall be full penetration butt welds except as described as follows. Circumferential lap welds will be allowed only on the roof portion of the tank. Any overlap of plates shall be seal welded to prevent moisture pockets. All exposed sharp edges, burrs and corners shall be

ground smooth. All weld splatter shall be removed by grinding. Any and all welds not uniform and continuous shall be ground smooth.

B. Inspection and Testing

1. Inspection of shop fabrication, surface preparation and welding procedures may be conducted by the ENGINEER or the ENGINEER's agent. The Contractor shall provide the ENGINEER with a schedule identifying all planned shop fabrication activities.

2. The quality of reservoir shell welded joints following installation of the door sheet shall be determined by visual inspection and the radiograph method as specified in AWWA D100- (latest edition) Sec. 11. The Contractor shall provide all necessary radiographic testing equipment and shall perform any and all tests as may be required by the ENGINEER. All radiographic films shall become the property of the OWNER. Initial field-testing will be conducted immediately following the beginning of field welding operations and inspection of radiographs will be made to establish the acceptable quality of work.

3. The Contractor shall provide and submit a written report as per the requirements of AWWA D100-(latest edition) Sec. 11.2.1 Radiographic methods shall be used for testing of all welds where possible. The Contractor shall notify the ENGINEER 24 hours in advance of any scaffolding relocation and shall provide ample opportunity for any and all testing and inspections as may be required by the ENGINEER.

C. Painting and Disinfection – Painting and disinfection shall be accomplished in accordance with requirements included elsewhere in these Contract Documents.

D. Post Fabrication & Erection Cut-Outs –

1. Special cut-outs within a fabricated steel panel for the temporary purpose of moving equipment into, out of, or off of the steel tank structure will not be allowed.

2. One cut-out will be allowed per reservoir according to Section 09 97 14, Steel Water Storage Tank Painting. The opening shall be accommodated by cutting out and rewelding an entire fabricated steel panel section at pattern layout seams.

3. Other cut-outs and patching of new, altered, or abandoned penetrations shall be as shown on the Drawings. The intent of this specification is to preserve the aesthetic appearance of symmetrical and uniform fabricated panel layouts and weld seams. It is not the intent of this specification to restrict the Contractor's use of external crane equipment for purposes of removing or installing equipment from or into the structure.

END OF SECTION

SECTION 33 05 17

PRECAST CONCRETE VALVE VAULTS AND METER BOXES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast concrete valve vaults.
2. Precast concrete meter boxes.

1.2 RELATED SECTIONS

A. Section 05 50 00, Metal Fabrications.
B. Section 31 05 16, Aggregates for Earthwork.
C. Section 31 23 16, Excavation
D. Section 31 23 23, Fill.
E. Section 33 11 10, Water Utility Distribution Piping.

1.3 REFERENCE STANDARDS

A. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.

2. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

3. ASTM A536 - Standard Specification for Ductile Iron Castings.

4. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

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

6. ASTM C33 - Standard Specification for Concrete Aggregates.

7. ASTM C150 - Standard Specification for Portland Cement.

8. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

9. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.

10. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.

11. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

12. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.

13. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

14. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).

15. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

16. ASTM D4104 - Standard Test Method (Analytical Procedure) for Determining Transmissivity of Nonleaky Confined Aquifers by Overdamped Well Response to Instantaneous Change in Head (Slug Tests).

17. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 COORDINATION

A. Coordinate Work with utilities within construction area.

B. The drawings identify precast vaults by manufacturer and model number. This information is provided for dimensional information only. Provide precast items in accordance with the requirements of this Section.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on valve vaults and meter boxes.

C. Shop Drawings for Precast Concrete Valve Vaults:

1. Indicate plan, location, and inverts of connecting piping.
2. All interior and exterior dimensions.
3. Location and type of lifting inserts, connection embeds and joints.
4. Details of reinforcement.
5. Covers or hatches.
6. Ladders and grating.

D. Manufacturer's Certificate: Certify that precast concrete valve vaults and meter boxes meet or exceed ASTM standards and specified requirements.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and inverts of buried pipe, components, and connections.

1.7 QUALITY ASSURANCE

A. Perform Work according to standards identified in Article 1.2 herein.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Transport and handle precast concrete units with equipment designed to protect units from damage.

C. Storage:

1. Store precast concrete valve vaults and meter boxes according to manufacturer instructions.

2. Do not place concrete units in position to cause overstress, warping, or twisting.

PART 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Performance and Design Criteria:

1. Watertight, Precast, Reinforced, Air-Entrained Concrete Structures:

a. Manufactured to conform to ASTM C913.

2. Loading:

a. Design to ASTM C890-A16 / AASHTO HS20 live loading and installation conditions.

b. Where vaults are below grade, a dead load of 125 pounds per cubic foot shall be added for the soil.

c. Lateral loads:

1) Static: 105 x Depth of fill (psf) triangular equivalent fluid pressure plus a surcharge of an additional three (3) feet of soil depth in areas subject to vehicular traffic (assume traffic load in all areas, unless indicated otherwise by the Contract Documents).

2) Seismic acceleration: UBC Zone 3 requirements (I = 1.25) where I = importance factor, I = 1.25, but not less than 0.20 g acting on structure mass. Seismic loading need not be considered simultaneously with traffic surcharge.

3. Minimum 28-Day Compressive Strength: 3,000 psi.

4. Honeycombed or retempered concrete is not permitted.

5. No block-outs or knockouts shall be cast into vault walls. All pipe penetrations shall be pre-formed or core-drilled at the required locations.

6. Accessories: Accessories such as ladders, floor grates at sumps, and other features shall be provided as shown on the Drawings.

7. Size: Vault dimensions shall be as required by the Drawings.

2.2 ACCESS HATCHES AND LIDS

A. Performance characteristics:

1. Covers: Shall be reinforced to support AASHTO H20-44 wheel load with a maximum deflection of 1/150th of the span. Manufacturer to provide structural calculations stamped by a registered professional engineer licensed in the State of Washington upon request. (Note: For installation in an off-street location where not subject to high density, fast moving traffic.)

2. Operation of the covers shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.

3. Operation of the covers shall not be affected by temperature.

4. Entire door, including all hardware components, shall be highly corrosion resistant.

B. Covers: ¼” (6.3 mm) Aluminum diamond plate cover material.

C. Frame: ¼" (6.3 mm) extruded aluminum with continuous anchor flange on all sides. Frame shall include a neoprene cushion/gasket to reduce debris infiltration as well as a 1-1/2" threaded drain coupling.

D. Hinges: Shall be specifically designed for horizontal installation and shall be through bolted to the cover with tamperproof Type 316 stainless steel bolts locknuts.

E. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators to provide smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The lower tube shall interlock with a flanged support shoe fastened to a formed ¼" gusset support plate.

F. A removable exterior turn/lift handle with a spring-loaded ball detent shall be provided to open the covers.

G. Covers shall be equipped with a hold open arm which automatically locks the covers in the open position.

H. Cover shall be fitted with hasp and loop to allow for locking with padlock.

I. A Type 316 stainless steel slam lock with fixed handle shall be mounted on the underside of the cover.

J. Hardware: Shall be anticorrosion throughout.

K. Finishes: Factory finish shall be mill finish aluminum.

L. Dimensions: 72 inches by 36 inches (frame opening), double door.

2.3 MATERIALS

A. Portland Cement:

1. ASTM C150, Type II.

B. Coarse Aggregates:

1. ASTM C33.
2. Graded 1 inch to No. 4 sieve.

C. Sand:

1. ASTM C33.
2. Fineness Modulus: 2.35.

D. Water:

1. Potable.

2. Clean and free of injurious amounts of acids, alkalis, salts, organic materials, and substances incompatible with concrete or steel.

E. Air-Entraining Admixtures: ASTM C260.

F. Reinforcing Steel:

1. Deformed Bars: ASTM A615, Grade 40 minimum.
2. Welded Wire Fabric: ASTM A185.

G. Gaskets:

1. Rubber gaskets: ASTM C443.

H. Joint Sealant:

1. ASTM C990.

I. Bedding:

1. Aggregate Bedding Material: Fill Type A1 as specified in Section 31 05 16, Aggregates for Earthwork. Size as shown in the Drawings.

2.4 FABRICATION

A. Fabricate precast reinforced concrete structures according to ASTM C913, to dimensions indicated on Drawings, and to specified design criteria.

B. Vaults may be formed with separate top and bottom slabs.

C. Walls shall be cast so that all sides are continuous at corners and their full length with no block-outs or knockouts.

D. Horizontal joints may be provided so that walls can be placed in horizontal segments.

E. All horizontal joints shall be keyed to prevent offsets and shall be provided with a watertight gasket.

F. Finish:

1. Formed surfaces shall be smooth and uniform with no fins, bulges, or other irregularities.

2. Any void greater in width than 1/2-inch or deeper than 3/8-inch shall be repaired.

3. Unformed interior slab surfaces shall have a smooth steel trowel finish.

4. Unformed exterior slab surfaces shall have a light broom finish applied to a steel trowel finish.

2.5 MIXES

A. Design concrete mix to produce required concrete strength, air-entrainment, watertight properties, and loading requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping connections, sizes, locations, and inverts are as indicated on Drawings.

3.2 PREPARATION

A. Ream pipe ends and remove burrs.
B. Remove scale and dirt from components before assembly.
C. Establish invert elevations for each component in system.
D. Hand trim excavation to suit valve vaults and meter boxes; remove stones, roots, and other obstructions.

3.3 INSTALLATION

A. Vaults/Meter and Bedding:

1. Excavate as specified in Section 31 23 16, Excavation for Work of this Section.

2. Hand trim excavation for accurate placement of vaults and meter boxes to elevations indicated.

3. Place bedding material level in one continuous layer to a minimum compacted depth of 6 inches.

4. Compact bedding material to 95 percent maximum density.

5. Bases for precast concrete structures shall be set level so that bedding material fully and uniformly supports them in true alignment with uniform bearing throughout full perimeter. Do not level bases by wedging gravel under the edges.

6. Backfill around sides of vaults and meter boxes as required by the Drawings.

B. Access Hatches and Lids

1. As shown on the Drawings.

2. When leveling bolts are used to set the vault top sections, ensure the load from the top slab is transferred through grout to the vault walls so that the load is not carried by the leveling bolts.

C. Connect piping.

3.4 FIELD QUALITY CONTROL

A. Request examination of subgrade by Engineer prior to placing aggregate base under precast materials.

B. Compaction Testing: In accordance with Field Quality Control requirements of Section 31 23 23, Fill.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

D. Frequency of Compaction Tests: In accordance with Section 01 45 00, Quality Control.

END OF SECTION

SECTION 33 11 10

WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Work under this Section applies to furnishing and installation of pipe materials, fittings and appurtenances normally encountered with water distribution systems, including potable water and fire water systems.

B. Section includes:

1. Pipe and fittings.
2. Flexible couplings.
3. Flanged coupling adapters.
4. Insulating flanged joints.
5. Tapping sleeves and valves.
6. Flexible expansion joints.
7. Bedding and cover materials.

C. Related Requirements:

1. General

a. Furnish and install all piping systems shown and specified in accordance with the requirements of the Contract Documents.

b. Each buried piping system shall be complete, with all necessary fittings, valves, accessories, lining and coating, testing, excavation, backfill and encasement, to provide a functional installation.

c. Piping layouts shown in the Drawings are intended to define the general layout, configuration, and routing for pipe, as well as the size and type of piping to be installed. The piping plans are not pipe construction or fabrication drawings.

d. The Contractor shall cause the Supplier of pipes, valves, fittings and appurtenances to coordinate piping installation such that all equipment is compatible and is capable of achieving the performance requirements specified in the Contract Documents.

e. It is the Contractor’s responsibility to develop the details necessary to construct all piping systems, to accommodate the specific equipment provided, and to

provide and install all spools, spacers, adapters, connectors, valves, gaskets, fittings, appurtenances etc., for a complete and functional system.

1.2 RELATED SECTIONS

A. Section 03 11 00 - Concrete Work.
B. Section 31 05 13 - Soils for Earthwork.
C. Section 31 05 16 - Aggregates for Earthwork.
D. Section 31 23 16 - Excavation.
E. Section 31 23 17 - Trenching.
F. Section 31 23 23 - Fill.
G. Section 33 05 17 - Precast Concrete Valve Vaults and Meter Boxes.
H. Section 33 12 13 - Water Service Connections.
I. Section 33 12 16 - Water Utility Distribution Valves.
J. Section 33 13 00 - Testing & Disinfecting of Water Utility Piping.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

B. American Society of Mechanical Engineers:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

2. ASME B16.5 - Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.

3. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.

4. ASME B31.10 - Standards of Pressure Piping.

C. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

4. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

5. ASTM A536, Standard Specification for Ductile Iron Castings.

6. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

7. ASTM D1598 - Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.

8. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

9. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

10. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

11. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

12. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

13. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

D. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.

4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

5. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.

7. AWWA C153 - Ductile-Iron Compact Fittings.

8. AWWA C219 - Bolted, Sleeve-Type Couplings for Plain-End Pipe

9. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.

10. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

11. AWWA C606 - Grooved and Shouldered Joints.

12. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

13. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm) for Water Transmission and Distribution.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

F. National Sanitation Foundation:

1. NSF Standard 61 - Drinking Water System Components – Health Effects.
2. NSF Standard 372 - Drinking Water System Components – Lead Content.

G. SUBMITTALS

H. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

I. Product Data: Submit data on pipe materials, pipe fittings, restrained joint systems, and accessories.

J. Shop Drawings: Indicate piping layout, including piping specialties.

1. Layout Schedule for applicable segments of proposed transmission main alignment. Schedule shall include layout plan and dimensions, schedule of pipe fittings and specials, materials and class for each size and type of pipe, joint details, pipe supports, and any special provisions required for assembly.

K. Lining and coating data.

L. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

M. Manufacturer’s handling, delivery, storage and installation requirements.

N. Field Quality-Control Submittals:

1. Pipeline hydrostatic testing plan.
2. Indicate results of Contractor-furnished tests and inspections.

O. Preconstruction Photographs:

1. Submit digital files of colored photographs of Work areas and material storage areas.

1.4 CLOSEOUT SUBMITTALS

A. As-Built Drawings:

1. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Materials:

1. Unless otherwise noted, all water works materials provided for the project shall be new, of first class quality and shall be made by reputable manufacturers.

2. All material of a like kind shall be provided from a single manufacturer unless otherwise approved by the Owner's Representative.

3. All material shall be carefully handled and installed in good working order free from defect in manufacture, storage and handling.

4. All pipe and fittings shall be manufactured in the United States of America, unless otherwise approved by the Owner.

B. Markings:

1. Pipes and Fittings: Mark each pipe and fitting at plant. Include date of manufacture, manufacturer's identification, specification standard, inside diameter of pipe, dimension ratio as applicable, pipe class as applicable, pipe number for laying purposes as applicable, and other information required for type of pipe.

2. Bolting materials (washers, nuts and bolts) shall be marked with material type.

C. Testing:

1. Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards.

1.6 MATERIAL DELIVERY, STORAGE, AND HANDLING

A. In accordance with manufacturer's written recommendations and as specified in these Contract Documents.

B. Pipe, specials, and fittings delivered to Project Site in damaged condition will not be accepted.

C. Storage:

1. Store and support pipe securely to prevent accidental rolling and to avoid contact with mud, water, or other deleterious materials.

2. Pipe and fittings shall not be stored on rocks, gravel or other hard material that might damage pipe. This includes storage area and along pipe trench.

3. Do not store materials in direct sunlight.

4. Gaskets: Do not allow contact with oils, fuels, petroleum, or solvents.

D. Handling:

1. Pipe and appurtenances shall be handled in accordance with manufacturer's recommendations or requirements contained in this section or subsequent sections dealing with the specific pipe material, whichever is more stringent.

2. Pipe shall be handled with proper equipment in a manner to prevent distortion or damage. Use of hooks, chains, wire ropes, or clamps that could damage pipe, damage coating or lining, or kink and bend pipe ends is not permitted.

3. Use heavy canvas, or nylon slings of suitable strength for lifting and supporting materials.

4. Lifting pipe during unloading or lifting into trench shall be done using two slings placed at quarter point of pipe section. Pipe may be lifted using one sling near center of pipe, provided pipe is guided to prevent uncontrolled swinging and no damage will result to pipe or harm to workers. Slings shall bear uniformly against pipe.

PART 2 PRODUCTS

2.1 WATER PIPING

A. General

1. All piping materials and specials shall meet the specifications of this Section and of the appropriate AWWA Standard Specifications. In the case of conflict, the more stringent specifications shall apply.

2. All coatings and materials specified herein which may come in contact with potable water shall conform to National Sanitation Foundation (NSF) Standard 61 and 372.

3. Minimum Pressure Ratings: Unless otherwise specified herein or shown in the Drawings, the minimum working pressure rating of all water works materials specified herein shall be 1.5 times the operating pressure or 150 psi minimum.

4. Gaskets:

    a. Material: Styrene Butadiene Rubber (SBR) composition.

B. Ductile Iron Pipe:

1. Centrifugally cast, conforming to AWWA Standard C151.

2. Coating: Asphaltic exterior coating in accordance with AWWA Standard C151.

3. Pipe Mortar Lining: Shop-applied NSF 61 cement mortar lining, smoothed finish, complying with AWWA C104.

4. Pipe Thickness Class:

    a. Comply with AWWA C151.

    b. Class 52, unless shown to be greater in the Plans.

        1) The Contractor shall be aware ductile iron piping with thickness class greater than Class 52 may have long fabrication and supplier lead times. The Contractor shall be responsible for coordinating product submittal and delivery times accordingly such as not to delay construction.

5. Polyethylene Encasement:

    a. Comply with AWWA C105.

    b. Polyethylene film shall be minimum 8-mil thick virgin linear low-density polyethylene (LLDPE).

6. Joints:

    a. Joint types shall be provided as identified in the Drawings and as required for the application.

    b. Mechanical Joints:

        1) Comply with AWWA C111.

    c. Push-on Joints:

        1) Comply with AWWA C111.

        2) Manufacturers, without exception:

            a) Tyton Joint by American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, McWane, and Pacific States Cast Iron Pipe.

            b) Fastite Joint by American Cast Iron Pipe Company.

    d. Restrained Joints:

        1) Joint restraint for pipe shall be accomplished with an integral lock mechanism, except as may be otherwise specified.

            a) Any such system shall be a manufacturer's standard proprietary design, shall be as recommended by the manufacturer for the application, and shall be performance proven.

        2) Restraining components:

            a) Ductile iron complying with AWWA C110 and/or C153, with the exception of a manufacturer’s proprietary design dimensions.

            b) Push-on joints for such fittings shall comply with AWWA C111.

        3) Deflection:

        4) The maximum pipe deflection shall not exceed one half of the manufacturer’s stated joint deflection allowance.

        5) Manufacturers:

            a) “Thrust-Lock”, Pacific States Cast Iron Pipe Company.

            b) “Fast Grip”, American Cast Iron Pipe Company.

c) “TR Flex”, United States Pipe and Foundry Company.

d) “Snap-Lok”, Griffin Pipe Products Company.

e) “Field-Lok”, United States Pipe and Foundry Company.

f) “Super Lock”, Clow

g) “Restrained Joint”, McWane

h) “MJ-TJ” pipe with “MEGALUGs”, Pacific States Cast Iron Pipe Company.

i) “Flex-Ring”, American Cast Iron Pipe Company

j) “MEGALUG”, EBAA Iron, Inc.

(1) Where any restrained joint system requires the use of a wedge-type mechanical restraint gland for restraint, the glands shall be provided in quantities as may be required and shall be considered incidental to the joint restraint system.

(2) Wedge-type mechanical restraining glands shall not be used to restrain the plain end of plain end ductile iron or cast iron fittings.

e. Flanged Joints:

1) Flat faced, complying with AWWA C115.

2) Bolt hole drilling according to ASME/ANSI B16.1, Class 125. Flanges shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown.

3) The Contractor shall coordinate with pipe, valve and fitting suppliers to make certain mating pipe, valve and fitting flanges match in bolt pattern.

4) Flange class:

a) Where design pressure is 150 psi or less, flanges shall conform to either AWWA C207 Class D or ASME B16.5 150-pound class.

b) Where design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to either AWWA C207 Class E or ASME B16.5 150-pound class.

5) AWWA flanges shall not be exposed to test pressures greater than 125% of rated capacity.

6) Threaded flanges:

   a) Ductile iron pipe spools with threaded flanges shall conform to AWWA C115.

   b) Installed only on pipe with a minimum Class 53 wall thickness.

7) Buried flanges:

   a) Flanged connections shall not be buried unless shown as such on the Drawings.

   b) Buried flanges shall be wrapped with 2 layers of 10 mil tape along edges of flanges.

8) Gaskets:

   a) Full faced, composed of synthetic rubber and 1/8-inch thick conforming to ASME B21.1 and AWWA C111.

   b) Ring gaskets will be permitted only where specifically noted in the Drawings and Specifications.

   c) Gaskets for flanged joints shall be as follows:

      (1) Pipe sizes between 6-inch and 24-inch diameter, service pressures of 150 psi or greater shall be Garlock 3760-U or equal.

      (2) Pipe sizes 4-inch diameter and under, service pressures of 150 psi or greater shall be Garlock 3505 or equal.

      (3) All pipe sizes with service pressures of 150 psi or less shall be Garlock 98206 or equal.

   d) Insulating flanged joints:

      (1) Full faced, conform to ANSI 16.21.

      (2) Material: Non-asbestos.

      (3) Suitable for operating and test pressures of the pipe system.

      (4) Manufacturer:

         (a) Garlock GYLON Style 3505 or equal.

2.2 FITTINGS:

A. Material: Ductile iron, complying with AWWA Standard C110.

1. Fittings conforming to AWWA C153 may be substituted in lieu of AWWA C110 fittings.

B. Fittings used for joining ductile iron and PVC pipe shall be of the type, size and strength designated on the Plans, elsewhere in the specifications.

1. Fittings shall be mechanical joint, push-on type, flanged or plain-end as required and shown on the Drawings.

2. All restraint systems and flanged fittings shall be provided with bolts and gaskets as specified herein.

C. Pressure ratings: As specified for joining pipe above and as shown on the Drawings.

D. Coating and Lining:

1. Asphaltic exterior coating in accordance with AWWA Standard C110.
2. Cement Mortar Lining: Comply with AWWA C104.

E. Following information cast upon fittings:

1. Manufacturer's identification.
2. Country of manufacture.
3. Pressure rating.
4. For bends, number of degrees and/or fractions of a circle.

F. Owner may require additional metallurgical documentation or other certifications.

2.3 NUTS, BOLTS AND WASHERS:

A. All bolts shall have heavy hex head with heavy hex nuts.

B. For operating pressures greater than 150 psi:

1. Bolts: Steel alloy composition. Comply with ASTM A193.
2. Nuts: Comply with ASTM A194, Grade 2H.
3. Washers: Comply with ASTM F436.

C. For operation pressures of 150 psi or less:

1. Bolts: Low-carbon steel composition. Comply with ASTM A307, Grade B.
2. Nuts: Comply with ASTM A563A, Heavy Hex.
3. Washers: Comply with ASTM F844.

2.4 FLEXIBLE COUPLINGS

A. General

1. All flexible couplings shall be constructed to inside diameters that properly fit the connecting pipes.

2. The Contractor shall be responsible for selecting sleeve lengths appropriate to the application, subject to review and approval of the Engineer, recognizing that longer sleeves allow for larger deflections and may ease installation.

B. Flexible Couplings:

1. Description:

a. Comply with AWWA C219.

b. Type: Bolted, sleeved.

c. Configuration: Straight, transition or reducing as shown in the Drawings.

d. Center rings and end rings: Ductile iron. Comply with ASTM A536.

e. Gaskets: Virgin styrene butadiene rubber (SBR) compounded for water service. Comply with ASTM D2000.

f. Bolts and nuts: High strength low alloy steel. Comply with AWWA C111.

g. Lining and coating: Factory-applied fusion bonded epoxy.

h. Working pressure: Up to 260 psi.

2. Manufacturers:

a. For 2-inch to 24-inch diameter:

1) Romac Industries, Inc. – Style 501 or equal.

b. For 12-inch diameter and larger:

1) Romac Industries, Inc. – 400 Series or equal.

C. Insulating Flexible Couplings:

1. The Contractor shall be responsible for selecting couplings appropriate to the application, subject to review and approval of the Engineer, recognizing that

different pipe materials will require specific sizing and material selection for couplings.

2. Description:

   a. Comply with Flexible Coupling specifications above.

   b. Insulating Boot: Ethylene propylene diene monomer (EPDM) compounded for water service. Comply with ASTM D2000.

3. Manufacturers:

   a. For 4-inch to 14-inch diameter:

      1) Romac Industries, Inc. – Style IC501 or equal.

   b. For 12-inch to 96-inch diameter:

      1) Romac Industries, Inc. – Style IC400 or equal.

D. Restrained Flexible Couplings:

1. Description:

   a. Body: Steel. Comply with ASTM A36.

   b. Restrained gland: Ductile iron. Comply with ASTM A536, Grade 65-45-12.

   c. Gaskets: Virgin styrene butadiene rubber (SBR) compounded for water service. Comply with ASTM D2000.

   d. Bolts and nuts: All-thread rod, at a minimum complying with ASTM A193 Grade B7. Nuts per ASTM A194 Grade 2H.

   e. Lining and coating: Factory-applied fusion bonded epoxy.

   f. Working pressure: [250] psi. Test pressure: [400] psi.

2. Manufacturers:

   a. Romac Industries, Inc. – Style 400RG
   b. EBAA Iron – 3800 MEGA-COUPLING

2.5 FLANGED COUPLING ADAPTERS

A. Flanged Coupling Adapters:

1. All flanged coupling adapters shall be constructed to diameters that properly fit the connecting plain end pipe and the flanged fitting.

2. Description:

a. Comply with AWWA C219.

b. Flange: AWWA Class D Steel Ring Flange, compatible with ANSI Class 125 & 150 bolt circles.

c. End ring and body:

1) Steel. Comply with ASTM A36.
2) Ductile iron. Comply with ASTM A536, Grade 65-45-12.

d. Flange: Compatible with ANSI Class 125 & 150 bolt circles.

e. Gaskets: Virgin styrene butadiene rubber (SBR) compounded for water service. Comply with ASTM D2000.

f. Bolts and nuts: High strength low alloy steel bolts and nuts. Comply with AWWA C111 composition requirements.

g. Lining and coating: Factory-applied fusion bonded epoxy.

h. Working pressure rating: Equal to the maximum rating of the flange.

3. Manufacturers:

a. Romac Industries, Inc.

1) Style FCA501

a) For 3-inch to 16-inch diameter.

2) Style FC400.

a) For 12-inch to 96-inch diameter.

B. Restrained Flanged Coupling Adapters:

1. Description:

a. Gland and flange body: Ductile iron. Comply with ASTM A536.

b. Flange: Compatible with ANSI Class 125 & 150 bolt circles.

c. Gaskets: Virgin styrene butadiene rubber (SBR) compounded for water service. Comply with ASTM D2000.

d. Restraining bolts and lugs: Ductile iron. Comply with ASTM A536.

e. T-bolts Bolts and nuts: High strength low alloy steel. Comply with AWWA C111 composition requirements.

f. Lining and coating: Factory-applied fusion bonded epoxy.

2. Manufacturers:

a. Romac Industries, Inc. – RFCA Restrained Flanged Coupling Adapters.
b. EBAA Iron – MEGAFLANGE Restrained Flange Adapter.

2.6 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:

1. Description:

a. Type: Dual compression.

b. Material:

1) Body: Stainless steel, Type 304.
2) Flanged outlet: Stainless steel, Type 304.

c. Outlet Flange Dimensions and Drilling: Comply with ASME B16.1, Class 150 and MSS SP-60.

d. Outlet Gasket:

e. Provide with Type 304 stainless steel test plug.

f. Nuts, bolts and washers: Stainless steel, Type 304.

2. Manufacturers:

a. Romac Industries, Inc. – Model STS 420
b. JMC Industries, Inc.

B. Tapping Valves:

1. Resilient wedge gate valves specified in Section 40 05 23.15, Gate Valves.

2.7 FLEXIBLE EXPANSION JOINTS

A. Description

1. Installed at locations indicated in the Drawings.

2. End connections: As shown in the Drawings.

3. Material: Ductile iron, AWWA C153.

4. Working pressure: 350 psi, minimum.

5. Construction:

   a. An expansion joint designed and cast as an integral part of a double ball and socket type flexible joint.

   b. Manufactured of ductile iron, conforming to requirements of AWWA C153 and ASTM A536.

   c. Deflection: Minimum of 15 degrees deflection per ball.

   d. Expansion:

      1) 12-inch diameter and under: 8 inches.
      2) Greater than 12-inch diameter: 16 inches.

   e. Each flexible expansion joint shall be hydrostatically tested to the manufacturer's published pressure rating prior to shipment.

   f. Lining: All interior "wetted" parts shall be shop-lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213 and shall be holiday tested with a 1500-volt spark test conforming to said specification.

   g. Coating: Coal tar epoxy.

6. Quality Assurance: Hydrostatically tested to manufacturer's published pressure rating prior to shipment.

7. Appropriately sized polyethylene sleeves, meeting AWWA C105 requirements, shall be included for direct bury applications.

B. Manufacturers

1. EBAA Iron, Inc. – Flex-Tend or equal.

2.8 UNDERGROUND PIPE MARKERS

A. As specified in Section 31 23 17, Trenching.

2.9 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. As specified in Section 03 30 00 - Cast-in-Place Concrete.
2. Type: reinforced, air entrained as shown in the Drawings.
3. Compressive Strength: Minimum 3,000 psi at 28 days.
4. Finish: Rough troweled.

B. Concrete Reinforcement: As specified in Section 03 20 00 - Concrete Reinforcing.

2.10 MATERIALS

A. Bedding and Cover:

1. Pipe Bedding: Coarse Aggregate Material Type A4, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

2. Pipe Zone Backfill: Coarse Aggregate Material Type A4, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

3. Trench Backfill from Pipe Zone to Finish Grade:

   a. Material type varies by location, as shown in the Drawings.

   b. Coarse Aggregate Material Type A1, crushed surfacing, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

   c. Subsoil Type S1, select native materials, as specified in Section 31 05 13, Soils for Earthwork.

2.11 ACCESSORIES

A. Concrete for Thrust Restraints: As specified in Section 03 11 00 - Concrete Work.

B. Miscellaneous Steel Rods, Bolt, Lugs, and Brackets:

1. Comply with ASTM A36 or ASTM A307.
2. Grade A carbon steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Preconstruction Site Photos:

1. Take photographs along centerline of proposed pipe trench; minimum one photograph for each 50 feet of pipe trench.

2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing Site features.

3. Include Project name, date taken, and sequential number of each photograph in physical log or CD.

B. Inspection:

1. All pipe sections, specials and jointing materials shall be carefully examined for defects.

2. No piping or related materials shall be laid that is known to be defective. Any defective piece installed shall be removed and replaced with a new pipe section in a manner satisfactory to the Engineer at the Contractor's expense.

3. Defective material shall be marked and removed from the job site before the end of the day.

C. Pipe Cutting:

1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.

2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.

3. Grind edges smooth with beveled end for push-on connections.

4. Prior to assembly of field cut pipe, the reference mark shall be re-established with a pencil or crayon. The location of the reference mark at the proper distance from the bevel end shall be in accordance with the manufacturer's recommendations.

D. Remove scale and dirt on inside and outside before assembly. Cleaning of each pipe or fitting shall be accomplished by swabbing out, brushing out, blowing out with compressed air, or washing to remove all foreign matter.

E. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Bedding:

1. Excavation:

a. Excavate pipe trench as specified in Section 31 23 17, Trenching for Work of this Section.

b. All pipe trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as scheduled on the Drawings.

c. Remove large stones or other hard matter which could damage pipe or impede consistent pipe bedding backfilling or compaction.

d. Trench base shall be inspected prior to placement of pipe.

e. Hand trim excavation for accurate placement of pipe to elevations as indicated on Drawings.

2. Dewater excavation as specified in Section 31 23 19, Dewatering to maintain dry conditions and to preserve final grades at bottom of excavation.

3. Provide sheeting and shoring as specified in Section 31 23 17, Trenching.

4. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, and compact to 95 percent of maximum density.

B. Piping:

1. Install pipe according to AWWA C600.

2. Handle and assemble pipe according to manufacturer instructions and as indicated on Drawings.

3. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.

4. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.

5. Sanitary Sewer Separation:

    a. Install new water lines and appurtenances in compliance with local and state regulations governing the horizontal and vertical separations between water and sewer facilities.

    b. Variance:

        1) If a variance is proposed due to requested design revisions or if an existing facility has been installed at a different location or elevation than indicated on the Plans, submit written proposal for review and approval by the Engineer.

        2) Include the reason for the variance, type of material and condition of the sewer line, location of the water and sewer facilities, horizontal and vertical skin-to-skin clearances and corrective measures proposed.

        3) Each variance will be considered on a case-by-case basis.

        4) Review Time: Allow a minimum of 5 working days review and response to each proposal.

6. Install ductile iron fittings according to AWWA C600.

7. Joints:

    a. Pipe jointing surfaces shall be clean and dry when preparing surfaces for joining.

    b. Lubricants, primers, adhesives, etc. shall be used as recommended by the pipe or joint manufacturer's specifications.

    c. The jointing materials or factory-fabricated joints shall then be placed, fitted, joined, and adjusted in such a manner as to obtain a watertight joint.

    d. Trenches shall be kept water-free and as dry as possible during bedding, laying and jointing.

    e. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of the pipe from any cause.

8. Flanged Joints: Not to be used in underground installations except within structures, unless shown otherwise in the Drawings.

9. Install pipe and fittings to the line and grade specified on the Drawings, with joints centered, pipe properly supported and restrained against movement, and all valve stems plumb. Re-lay pipe that is out of alignment or grade.

10. High Points:

    a. Install pipe with no high points, unless otherwise shown in the Drawings.

    b. If unforeseen field conditions arise that necessitate high points, install air release valves as directed by Engineer.

11. Bearing:

    a. Install pipe to have bearing along entire length of pipe.

    b. Excavate bell holes to permit proper joint installation where necessary or as directed by Engineer.

    c. Do not lay pipe in wet or frozen trench.

12. Prevent foreign material from entering pipe during placement.

13. Install pipe to allow for expansion and contraction without stressing pipe or joints.

14. Close pipe openings with watertight plugs during Work stoppages.

15. All pipe ends which are to be permanently closed shall be plugged or capped and restrained against internal pressure.

16. Install access fittings to permit disinfection of water system performed under Section 33 13 00 - Disinfecting of Water Utility Distribution.

17. Cover:

    a. Establish elevations of buried piping with not less than 36 inches of cover.

    b. Measure depth of cover from final surface grade to top of pipe barrel.

C. Tapping Sleeves and Valves:

1. As indicated on Drawings and according to manufacturer instructions.

D. Polyethylene Encasement:

1. Encase ductile iron piping in polyethylene to prevent contact with surrounding backfill material.

2. Comply with AWWA C105.

E. Thrust Restraints:

1. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks at locations shown in the Drawings and as required to facilitate testing of lines.

2. Pour concrete thrust blocks against undisturbed earth.

3. Locate thrust blocks to ensure that pipe and fitting joints will be accessible for repair.

4. Provide thrust restraint bearing area on subsoil as shown in detail's within the Drawings.

5. Install tie rods, clamps, setscrew retainer glands, or restrained joints.

6. Protect metal-restrained joint components against corrosion with polyethylene film as specified herein.

7. Do not encase pipe and fitting joints to flanges.

F. Backfilling:

1. Backfill of piping systems shall be as specified in Section 31 23 17, Trenching.

G. Testing and Disinfection of Potable Water Piping System:

1. In accordance with AWWA C600, AWWA C651 and as specified in Section 33 13 00, Testing and Disinfecting of Water Utility Distribution.

2. All chlorinated water used in disinfection of the water main shall either be discharged through an approved connection to a public sanitary sewer system or shall be dechlorinated to limits acceptable by the Washington State Department of Ecology (DOE) prior to discharge into any storm drainage system or open drainage way.

3. No chlorinated water shall be discharged into a storm drainage system or open drainage way without dechlorination under a plan meeting DOE's requirements.

3.4 FIELD QUALITY CONTROL

A. Compaction Testing: See Section 31 23 17, Trenching for Compaction Testing requirements for pipe trenches.

END OF SECTION

SECTION 33 11 10.30

HIGH DENSITY POLYETHYLENE PIPE

PART 1 GENERAL

1.1 SCOPE

This section covers high density polyethylene (HDPE) pressure pipe. HDPE pipe shall be furnished complete with all fittings, jointing materials, and appurtenances.

1.2 REFERENCE SPECIFICATION

Refer to the latest edition of ANSI/AWWA C906, AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution and Transmission.

1.3 SUBMITTALS

A. Complete layout drawings, details, and specifications covering all HDPE piping and accessories shall be submitted.

B. Certified copies of physical and chemical test results shall be submitted for the materials to be provided.

C. An affidavit of compliance and certification of special quality assurance testing shall be submitted.

PART 2 MATERIALS

2.1 GENERAL

The nominal diameter(s) of the pipe(s) are as shown on the Drawings.

2.2 MATERIALS

A. Pipe

Pipe shall meet the requirements of ANSI/AWWA C906, Standard PE Code Designation - PE 3408, minimum cell classification - PE 334434C (ASTM D3350). Pipe shall be iron pipe size (IPS) outside diameter (OD). All HDPE pipe and fittings shall have a dimension ratio (DR) of at least 11.

B. Joints and Fittings

Pipe shall be joined using thermal butt fusion method only per ASTM D3261. HDPE

fittings shall be of the same class as the HDPE piping.

C. Connections with Other Pipe Types

Connections between HDPE pipe and other pipe types shall be made using pipe and fittings as shown on the plans.

PART 3 EXECUTION

3.1 INSPECTION

Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. All defective pipe and fittings shall be removed from the site of the work.

3.2 PREPARATION

The interior of all pipe and fittings shall be thoroughly cleared of all foreign matter prior to installation. Precautions shall be taken to prevent foreign material from entering the pipe during installation.

3.3 HANDLING

Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in a sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage or change the pipe and fittings. Hooks inserted in ends of pipe shall have broad well-padded contact surfaces. Pipe shall not be stored uncovered in direct sunlight.

3.4 JOINING

A. Sections of polyethylene pipe shall be joined into continuous lengths on the job site above ground per ASTM D3261. The joining method shall be the thermal butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements for 400°F, alignment, and 75 psi interfacial fusion pressure.

B. Butt fusion joining shall be 100 percent efficient providing joint weld strength equal to or greater than the tensile strength of the pipe. Socket fusion will not be allowed. Extrusion welding or hot gas welding of HDPE shall not be used for pressure pipe applications or in fabrications where shear or structural strength is important.

3.5 HYDROSTATIC PRESSURE TESTING

Test all sections of HDPE pipe per the requirements of Section 33 13 00, Testing and Disinfecting of Water Utility Piping.

3.6 CONNECTIONS TO HDPE PIPE

If the HDPE pipe is installed using horizontal directional drilling methods, after pullback of the HDPE pipe, the pipe shall remain in the drilled hole at least twenty-four (24) hours before any connections to or cutting of the pipe are performed.

END OF SECTION

SECTION 33 11 50

EXISTING PIPE ABANDONMENT

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the removal of existing buried piping and abandonment in place of existing buried piping.

B. Section includes:

1. Pipe removal.
2. In-place abandonment of pipe.

1.2 RELATED SECTIONS

A. Section 03 60 00, Grouting.
B. Section 31 23 16, Excavation.
C. Section 31 23 17, Trenching.
D. Section 31 23 19, Dewatering.
E. Section 31 23 23, Fill.
F. Section 31 23 24, Flowable Fill.

1.3 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00, Submittal Procedures.

B. Piping Abandonment Plan:

1. Identify locations specified for pipe abandonment.
2. Provide method to be utilized to abandon the pipe, including whether the pipe will be left in place or removed in its entirety.

C. Non-Shrink Grout: Product data in accordance with Section 03 60 00, Grouting.

D. CLSM: Mix designs in accordance with Submittal requirements of Section 31 23 24, Flowable Fill.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

A. Permits: The Contractor is responsible for obtaining all necessary permits required for completion of the work described herein.

B. Protection of Persons and Property: Meet all federal, state and local safety requirements for the protection of workmen, other persons, and property in the vicinity of the work and requirements of the General Provisions.

1.5 PROTECTION OF EXISTING WORK

A. Carefully examine the Contract Documents to determine the extent of the work of this Section.

B. Carefully coordinate the work of this Section with all other work and construction.

C. Take all necessary precautions to prevent damage to existing facilities or utilities which are to remain in place, and be responsible for any damages to existing facilities or utilities, which are caused by the operations.

1.6 REPAIR OF DAMAGE

A. Work procedures shall provide for safe conduct of the work; careful removal and disposition of materials and equipment; protection of facilities, utilities and property which are to remain undisturbed; coordination with existing facilities and utilities to remain in service.

B. Any damage to existing facilities or utilities to remain as caused by the Contractor's operations shall be repaired to acceptance of Engineer.

C. Damaged items shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of work of this contract.

1.7 EXISTING CONDITIONS

A. If the pipe material contains any hazardous materials, such as asbestos, requiring special handling upon removal, it is the responsibility of the Contractor to remove and dispose of the material in accordance with all applicable federal, state and local regulations.

PART 2 PRODUCTS

2.1 OWNERSHIP OF EXISTING MATERIALS

A. All materials, equipment, miscellaneous items and debris involved, occurring or resulting from pipe removal work shall become the property of the Contractor at the place of origin, unless otherwise specified in the Drawings or by the Engineer.

2.2 CONTROLLED LOW STRENGTH MATERIAL

A. As specified in WSDOT Standard 2-09.3(1)E.

PART 3 EXECUTION

3.1 PIPE REMOVAL

A. Where identified on the Drawings, remove and dispose of all pipe material and associated appurtenances.

1. All fire hydrants, air release valves service lines and appurtenances being abandoned shall be removed to 36 inches below finished grade.

2. Existing service line appurtenances, including valve and meter boxes, shall be removed to 36 inches below finished grade.

B. All exposed ends of pipes and fittings to remain in service shall be capped or plugged with an appropriate ductile iron blind flange, cap or plug and restrained.

1. A pipe shall be considered in service if it is possible to flood the pipe with water by opening valves in the water system.

C. All excavation and backfilling associated with pipe removal shall be performed in accordance with 31 23 17, Trenching.

3.2 IN-PLACE ABANDONMENT OF PIPING

A. Where identified on the Drawings, abandon pipe in place.

B. All exposed ends of pipes being abandoned in place shall be cut and plugged with a minimum of two (2) feet of non-shrink grout.

C. Prior to placing grout, roughen interior pipe surface and apply epoxy bonding agent.

3.3 FILLING PIPE WITH CLSM

A. Where identified on the Plans, pipes greater than 12 inches in diameter to be abandoned-in-place shall be filled with CLSM.

B. CLSM shall be placed in a manner to ensure complete filling of the pipe, leaving no cavities or voids.

C. Install hot taps, saddles, fill lines and appurtenances as necessary for pumping CLSM from the surface into the pipe being filled.

D. CLSM shall be pumped up grade from fill lines rigidly connected to the pipes being filled.

E. Placement of CLSM by free-flowing (non-pumped) methods will not be acceptable.

F. Fill lines shall be located at elevations lower than the pipe being filled.

G. As the CLSM is being placed, use other fill lines as view ports to ensure complete filling of the pipes.

H. Relocate pumping equipment as necessary to complete filling of the pipes.

I. Excavate and cut access holes in the pipes as necessary to complete filling operations.

J. Perform pipe filling operations in a manner to eliminate all air pockets.

K. Submit volume calculations for CLSM placed in each filled segment of piping to verify that pipelines have been completely filled.

3.4 CLEANUP

A. During and upon completion of work of this Section, promptly remove all unused tools and equipment, surplus materials and debris.

B. Adjacent areas shall be returned to their existing condition prior to the start of work.

END OF SECTION

SECTION 33 12 13

WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. This section includes pipe materials, fittings, valves, meters and backflow preventers encountered with service connections 2 inches in diameter and smaller from the main to a water meter.

B. Section Includes:

1. Pipe and fittings for 2- inch diameter and smaller water service connections.
2. Corporation stop assemblies.
3. Curb stop assemblies.
4. Meter setting equipment.
5. Water meters.
6. Backflow preventers.
7. Sampling stations.
8. Underground pipe markers.
9. Precast concrete vaults.
10. Bedding and cover materials.

C. Related Requirements:

1. Section 31 05 13 - Soils for Earthwork: Backfill soil type.

2. Section 31 05 16 - Aggregates for Earthwork: Bedding and cover material type.

3. Section 31 23 17 - Trenching: Excavation of pipe trench.

4. Section 31 23 23 - Fill: Backfilling of trench.

5. Section 33 05 13 - Manholes and Structures: Soil backfill type, manholes, and covers.

6. Section 33 05 16.13 - Precast Concrete Utility Structures: Valve vaults.

7. Section 33 05 17 - Precast Concrete Valve Vaults and Meter Boxes: Valve vaults.

8. Section 33 13 00 - Testing and disinfecting of Water Utility Distribution: Flushing and disinfecting of water system.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

2. AASHTO T180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:

1. ASME B16.15 - Cast Bronze Threaded Fittings.

C. American Society of Sanitary Engineering:

1. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.

2. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

D. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.

2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

4. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.

5. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

6. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

7. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

8. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

9. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

10. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

11. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

1. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.

2. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.

3. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.

4. AWWA C800 - Underground Service Line Valves and Fittings.

5. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.

6. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

G. National Sanitation Foundation International:

1. NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects
2. NSF/ANSI Standard 372 - Drinking Water System Components - Lead Content

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.

C. Shop Drawings: Indicate details showing meter boxes, vaults and accessories.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping mains, connections, thrust restraints, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Unless otherwise noted, all water works materials provided shall be new, of first class quality and shall be made by reputable manufacturers.

B. All material of like kind shall be provided from a single manufacturer unless otherwise approved by the Engineer.

C. All material shall be carefully handled and installed in good working order free from defect in manufacture, storage and handling.

D. Where an item is to be used but does not have its quality specified herein, it shall be equal to that specified in the appropriate American Water Works Association (AWWA) Standard Specification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store products and materials off ground and under protective coverings and away from walls.

C. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

PART 2 PRODUCTS

2.1 GENERAL

A. Service line material shall conform to the latest version of AWWA C800 and as follows:

1. Minimum working pressure rating of all service line material shall be 150 psi.

2. All water works materials provided shall be rated for the test pressures indicated for the water main and as specified in Section 33 13 00, Testing and Disinfection of Water Utility Pipelines.

B. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 WATER PIPING AND FITTINGS

A. Copper Tubing:

1. Comply with ASTM B88.

2. Type K, annealed, seamless.

3. Fittings: Cast bronze alloys, threaded. Conform to ASTM B584, meeting “lead free” requirements above, and ASME B16.15.

a. Mechanical surfaces shall have a 100% machine finish with no gaps or low spots due to insufficient parent material.

b. All fittings shall either be stamped or embossed with the manufacturer’s name.

c. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

d. Manufacturers:

1) Ford.
2) Mueller.

4. Joints: Compression.

B. Polyethylene Tubing:

1. Comply with AWWA C901.

2. Tubing shall be high molecular mass with a minimum 200 psi rating.

a. 3/4-inch and 1-inch diameter tubing: SDR 7 (iron pipe size, IPS) or SDR 9 (copper tube size, CTS).

b. 1 1/2-inch and 2-inch diameter tubing: SDR 9 (copper tube size, CTS).

3. Fittings: Comply with AWWA C901, molded.

4. Joints:

a. Compression: Utilize stainless steel inserts.
b. Stab: Utilize internal grip ring and O-ring seal.

2.3 CORPORATION STOP ASSEMBLIES

A. Corporation Stops:

1. Body: Bronze alloy.

2. Valve Type: Ball.

a. Constructed of the same material as the body.

b. A seat to support the ball or coating for the ball shall be composed of Teflon, Nitrile or another material proven not to deteriorate when exposed to chemicals seat such as chloramines.

3. Direct Tapping: Corporation stops for direct tapping shall have AWWA tapered thread inlet and outlet connections compatible with service piping specified.

4. Less Than or Equal to 1-Inch Diameter:

a. Inlets: AWWA tapered thread or male iron pipe thread.

b. Outlets: Connections compatible with either copper or polyethylene tubing.

c. Thread patterns for the saddle outlet and corporation stop inlet shall be compatible for proper installation.

5. Greater Than 1-Inch Diameter:

    a. Inlets: Male iron pipe thread.
    b. Outlets: Connections compatible with connecting service pipes.

B. Service Saddles:

1. Material: Ductile iron, bronze or stainless steel.

2. Coating: Epoxy or nylon.

3. For Services Less Than or Equal to 1-Inch Diameter:

    a. Single strap.
    b. AWWA tapered thread or female iron pipe thread outlet.

4. For Services Greater Than 1-Inch Diameter:

    a. Double strap.
    b. Female pipe thread outlet.

5. Designed to hold pressures in excess of pipe working pressure.

6. Saddles used on PVC shall be formed for PVC pipe and shall have flat, stainless steel straps.

C. Manufacturers:

1. Ford.
2. Mueller.

2.4 CURB STOP ASSEMBLIES

A. Curb Stops:

1. Body: Bronze alloy. Comply with ASME B16.15.

2. Valve Type: Ball.

    a. Constructed of the same material as the body.
    b. A seat to support the ball or coating for the ball shall be composed of Teflon, Nitrile or another material proven not to deteriorate when exposed to chemicals seat such as chloramines.

3. Sealing: Positive pressure.

B. Manufacturers:

1. Ford.
2. Mueller.

2.5 METER SETTING EQUIPMENT

A. Description:

1. Height: 12 inches.

2. Material: Copper.

3. Construction:

a. Angle meter stop with drilled padlock wing.

b. Angle check valve.

c. Inlets and Outlets: Horizontal setting, with matching couplings, fittings, and stops.

4. Furnish test valves.

5. For services 1-inch and smaller:

a. Meters saddle nuts for installation and removal of meter.

6. For services greater than 1-inch:

a. Equip with a locking bypass.

B. Manufacturers:

1. Ford.
2. Mueller.

2.6 WATER METERS

A. Supplied by Owner.

2.7 BACKFLOW PREVENTERS

A. As specified in Section 40 05 13, Common Work Results for Process Piping.

2.8 SAMPLING STATIONS

A. Manufacturers:

1. Kupferle Foundry Company, Eclipse No. 88.

B. Sampling Stations:

1. Enclosure: Cast-aluminum. Lockable, non-moveable.

2. Interior Piping: Brass, 3/4-inch diameter FIP.

3. Exterior Piping: Galvanized steel, 3/4-inch diameter FIP. Depth of bury as shown in the Drawings.

4. Vent Tube: Copper, with 1/4-inch diameter pet cock.

2.9 UNDERGROUND PIPE MARKERS

A. As specified in Section 31 23 17, Trenching.

2.10 METER BOXES

A. As specified in Section 33 05 17, Precast Concrete Valve Vaults and Meter Boxes.

2.11 MATERIALS

A. Bedding and Cover:

1. Pipe Bedding: Coarse Aggregate Material Type A4, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

2. Pipe Zone Backfill: Coarse Aggregate Material Type A4, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

3. Trench Backfill from Pipe Zone to Finish Grade:

a. Material type varies by location, as shown in the Drawings.

b. Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

c. Subsoil Type S1, as specified in Section 31 05 13, Soils for Earthwork.

PART 3 EXECUTION

3.1 GENERAL

A. All service lines shall be installed continuous, without joints or splices, complete from the new water main (insulating corporation stop) to the new meter location or as otherwise shown.

B. Install service pipelines perpendicular to the main, unless shown otherwise.

C. Install service runs parallel to existing services with a perpendicular distance of 2 feet, minimum to 5 feet, maximum from existing services and a minimum perpendicular distance of 18 inches from property line for new services.

D. For service renewals, terminate service run inside of existing meter box as described below.

3.2 INSTALLATION

A. Construct the depth of trench for service connection piping to provide a minimum of 30 inches of cover over the top of the pipe, unless otherwise shown.

B. Excavation, backfill and surface restoration shall be performed in accordance with provisions stated in Section 31 23 17, Trenching.

C. Do not damage the main in any way during the service installation.

D. Water Main Tap

1. All direct service taps shall be made with a drilling and tapping machine intended for use on ductile iron pipe as manufactured by Mueller or approved equal. Hand held equipment is not allowed. Coupons shall be removed from pipe.

    a. The drilling and tapping machine shall have alignment tool guides and a placement strap.

2. Direct threaded taps shall engage a minimum of four (4) full threads.

3. Direct taps shall require the use of two (2) layers of 3 mil tetrafluoroethylene (TFE) tape on the threads of the corporation stop. Liquid TFE will not be allowed.

4. Direct taps for 1-inch diameter services are allowed only on mains that are 6 inches in diameter or larger.

5. Service saddles are required on water mains 4 inches in diameter and larger and for all services taps larger than 1-inch diameter.

6. Install corporation stop at a 45-degree angle from the cross section vertical axis of the water main being tapped, unless otherwise shown on the Plans.

7. Install swing joint on all 2-inch diameter services.

E. Piping

1. Cut service pipes using tools specifically designed to leave a smooth, even, and square end on the material being cut.

2. Ream cut ends to the full inside diameter of the pipe.

3. Clean pipe ends to a sound, smooth finish prior to using compression connections which seal to the outside surface of the pipe.

F. Water Meters:

1. Install positive displacement meters according to AWWA M6 and as shown in the Drawings.

G. Backflow Preventers:

1. Install backflow preventers where indicated on Drawings and according to manufacturer instructions.

2. Testing and Installation Requirements: Comply with local water company requirements and plumbing codes.

H. Service Connections:

1. Install water service according to Lewis County Standard Plans.

2. Install water meter as shown in Lewis County Standard Plan No. W-3.

3. Locate meter box as shown in the Drawings. Final location to be determined in the field by Engineer.

I. Service Renewal:

1. Install service line and angle meter stop from the water main to the inside of existing meter box location.

2. Where service renewals are to be connected to existing meters, stub up and terminate service run at angle meter stop where shown.

3. Where no meter is to be installed, place angle meter stop at 18 inches from face of curb with 12 inches to the springline in an approved box.

4. Owner will connect all service lines at the new meters or to existing service piping as shown.

5. Adjust meter box to finished grade after the service piping has been installed and surface has been restored to the satisfaction of the Engineer.

J. Trenchless Installation:

1. All water service installations under existing pavement, curbs, sidewalks or other surface improvements may be installed by trenchless construction techniques at Contractor option where ground conditions are favorable and such methods will not disturb foundations under curbs, sidewalks and other structures.

2. The Owner's Representative must approve all trenchless installation methods.

3. Where trenchless pipe installation is used, payment for the pipe installation will be made for the equivalent trench excavation and backfill as if the open cut method was used. Payment will not be made for surface restoration including pavement, curbs, sidewalks and other surface improvements whose replacement is avoided by use of a trenchless method, such as tunneling.

3.3 CORROSION PROTECTION

A. Install cathodic protection items where required, including dielectric insulating corporation stops, dielectric insulating joints, tape wrap, and grounding rod in accordance with Section 26 42 01, Pipeline Cathodic Protection Systems.

3.4 FLUSHING AND DISINFECTION

A. Flush and disinfect all service connections and appurtenances in accordance with Section 33 13 00, Testing and Disinfection of Water Utility Distribution Pipelines.

3.5 FIELD QUALITY CONTROL

A. Pressure test water distribution system according to AWWA C600 and Section 33 11 10, Water Utility Distribution Piping.

B. Compaction Testing for Bedding: See Section 33 11 10, Water Utility Distribution Piping for compaction testing requirements. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION

SECTION 33 12 16

WATER UTILITY DISTRIBUTION VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes valves and valve boxes for installation with buried water distribution main, including fire hydrants and tapping sleeves.

B. Section Includes:

1. Valves.
2. Valve boxes.
3. Valve operator extensions.

C. Related Requirements:

1. Section 03 11 00 - Concrete Work: Concrete for thrust restraints.

2. Section 33 11 10 - Water Utility Distribution Piping: Piping trenching, backfilling, and compaction requirements.

3. Section 33 12 13 - Water Service Connections: Pipe materials, fittings, and service connection appurtenances and installation requirements.

4. Section 33 13 00 - Testing and Disinfecting of Water Utility Distribution: Flushing and disinfection requirements.

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

2. ASME B16.5 - Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.

3. ASME 1.20.1 - General Purpose Pipe Threads (Inch)

B. American Water Works Association:

1. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. Through 72 In.

2. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.

3. AWWA C550 - Protecting Interior Coatings for Valves and Hydrants.

4. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.

5. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.

C. ASTM International:

1. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

2. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

D. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. The Contractor shall cause the Supplier of valves to coordinate installation such that all pipes, valves, fittings, appurtenances and equipment are compatible and capable of achieving the performance requirements specified in the Contract Documents.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's latest published literature. Include illustrations, installation and maintenance instructions, and parts lists.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

E. Lining and coating data.

F. Valve Labeling: Schedule of valves to be labeled indicating in each case the valve location and the proposed labeling for the valve.

G. Certification of Valves Larger than 12 inches: Furnish certified copies of hydrostatic factory tests, indicating compliance with applicable standards.

H. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

I. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves.
B. Operation and Maintenance Data: Submit information for valves.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Tools: Not used.

1.7 QUALITY ASSURANCE

A. Cast manufacturer's name, maximum working pressure, size of valve and year of fabrication into valve body.

B. Valve Testing: Each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

C. Certification: Prior to shipment, submit for all valves over 12 inches in diameter, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc. Valves tested and supplied shall be trackable and traceable by serial number, tagged or otherwise noted on valve, upon arrival to Site.

D. Unless otherwise noted, all water works materials provided for the Project shall be new, of first class quality and shall be made by reputable manufacturers.

E. All material of a like kind shall be provided from a single manufacturer, unless otherwise approved by the Engineer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves and accessories for shipment according to applicable AWWA standards.

B. Seal valve and ends to prevent entry of foreign matter.

C. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

D. Storage:

1. Store materials in areas protected from weather, moisture, or other potential damage.

2. Do not store materials directly on ground.

E. Handle products carefully to prevent damage to interior or exterior surfaces.

F. All defective or damaged materials shall be replaced with new materials at no cost to the Owner.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 RESILIENT WEDGE GATE VALVES

A. As specified in Section 40 05 23.15, Gate Valves.

B. Connecting Hardware:

1. As specified in Article 2.3, Nuts, Bolts and Washers of Section 33 11 10, Water Utility Distribution Piping.

C. Gaskets:

1. As required for the end connection types specified in Section 33 11 10, Water Utility Distribution Piping.

2.3 RUBBER-SEATED BUTTERFLY VALVES

A. As specified in Section 40 05 23.18, Butterfly Valves.

B. Operation:

1. All buried valves shall be provided with 2-inch square operating nuts.

C. Connecting Hardware:

1. As specified in Article 2.3, Nuts, Bolts and Washers of Section 33 11 10, Water Utility Distribution Piping.

D. Gaskets:

1. As required for the end connection types specified in Section 33 11 10, Water Utility Distribution Piping.

2.4 ACTUATORS

A. Unless otherwise indicated, all valves shall be furnished with manual actuators.

B. Actuators shall be sized for the valve design pressure in accordance with AWWA C504.

C. All gear-assisted valves that are buried and submerged shall have the actuators hermetically-sealed and grease-packed.

D. All valves 6 inches to 30 inches in diameter may have traveling-nut actuators, worm-gear actuators, spur- or bevel-gear actuators, as appropriate for each valve.

2.5 VALVE BOXES

A. Provide all buried valves with valve boxes, covers and risers.

B. Valve Boxes:

1. Materials: Cast iron.

2. Construction:

a. Walls not less than 3/16-inch thick at any point.
b. Internal diameter not less than 5 inches.

3. Type: Two-piece extension.

4. Manufacturers:

a. Olympic Foundry.
b. Brooks Products.

C. Covers:

1. Construction:

a. Prevents dislodging and rotation from traffic.

b. Allows a hand-held pry bar to be applied for easy removal.

2. Materials: Cast iron.

3. Lid Inscription: WATER or W.

4. Manufacturers: Matching that of valve box.

D. Riser:

1. PVC Pipe:

a. ASTM D3034, SDR 35 PVC.
b. White, Schedule 40, 8-inch diameter.
c. Length as shown on details in the Drawings.

2.6 VALVE OPERATOR EXTENSIONS

A. As shown in the Drawings.

B. Provide operator extensions to a maximum of 12 inches below grade where depth to valve exceeds 36 inches.

2.7 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type as specified in Section 03 11 00 - Concrete Work.

PART 3 EXECUTION

3.1 PREPARATION

A. Conduct operations to not interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures, utilities, and landscape in immediate or adjacent areas.

B. Identify required lines, levels, contours, and datum locations.

C. Locate, identify, and protect from damage utilities to remain.

D. Access:

1. All valves shall be installed to provide easy access for operation, removal, and maintenance.

2. Avoid conflicts between valve operators and above grade construction such as structural members or handrails.

E. Valve Accessories:

1. Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the Contractor to properly assemble and install these various items so that all systems are compatible and operating properly.

2. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

3.2 INSTALLATION

A. General:

1. All valves, operating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as shown in the Drawings and as specified herein.

2. Valves shall be firmly supported to avoid undue stresses on the pipe.

3. Stem extensions shall be braced at no greater than 10 feet intervals and be provided with double universal joints to allow for misalignment, where applicable.

B. Perform trench excavation, backfilling, and compaction as specified in Section 33 11 10, Water Utility Distribution Piping.

C. Install valves in conjunction with pipe laying.

D. Set valves plumb.

E. Provide buried valves with valve boxes installed flush with finished grade.

1. Valves installed out of paved or otherwise hard-surfaced areas shall be set in a concrete pad at finished grade.

2. Concrete valve box pads shall be 18 inches square and be not less than 6 inches thick.

F. Disinfection of Water Piping System:

1. Flush and disinfect system as specified in Section 33 13 00, Testing and Disinfecting of Water Utility Distribution.

3.3 FIELD QUALITY CONTROL

A. Pressure test valving for water distribution system according to AWWA C600 and in accordance with Section 33 13 00, Testing and Disinfecting of Water Utility Piping.

END OF SECTION

SECTION 33 12 23

WATER UTILITY PUMPING STATIONS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. PACKAGED PUMP STATION

1. The packaged pump station supplier shall provide a UL QCZJ listed, skid mounted, potable booster pump station complete, with all components and functions as indicated on the Drawings and as herein specified. It shall include TWO (2) END-SUCTION CENTRIFUGAL Duty Pumps, with each pump operated across-the-line, and ONE (1) VERTICAL MULTI-STAGE Recirculation Pump operated across-the-line.

2. The pump station shall be enclosed in a marine grade aluminum enclosure.

3. The pump station shall meet the performance requirements outlined in Part 2 Products.

B. FACTORY TESTING

1. The pump station shall undergo and pass the following system performance tests; all test results shall be made available to the owner.

   a. Hydrostatic Testing. The packaged pump station shall undergo hydrostatic testing that meets ANSI/HI specifications and standards.

   b. Vibration Testing. The packaged pump station shall undergo vibration testing that meets ANSI/HI 9.6.4—Vibration Measurement and Allowable Values—specifications and standards.

   c. Flow Testing. The packaged pump station shall undergo Hydraulic Performance Acceptance testing that meets ANSI/HI 14.6 specifications and standards.

C. WARRANTY

The Manufacturer shall warrant the original buyer that the packaged pump station shall be free from defects in material and workmanship for a period of 12 MONTHS from the date of placing the Equipment in operation, or 16 MONTHS from the date of completion of manufacture of the Equipment, whichever shall occur first. If the pump station manufacturer performs the technical start-up, the motor control panel shall be covered under Warranty for an additional 3 YEARS.

D. SUBMITTALS

Submittals shall be well organized, labeled, and presented in a professional manner. Sloppy or poorly presented submittals shall be rejected. The pump station manufacturer shall submit the following items as part of a complete submittal package:

1. See Section 01 33 00, Submittal Procedures. At a minimum, submittals shall include the following:

    a. Shop Drawings

    b. Electrical Schematics

    c. Technical data sheets for all major system components, including:

        1) Pump performance curves and datasheets

        2) Control Panel Components: VFD, PLC, Touchscreen Interface, Panel Enclosure, & UL 508A Certification

        3) Powder coating

        4) Valves

        5) Instrumentation

        6) Electronic files and fully annotated print copies of all PLC and HMI application programs, as-built.

E. OPERATIONS AND MAINTENANCE MANUAL

An operation and maintenance manual shall be furnished at the time of start-up and initial training. The owner shall also receive training specific to the pump station. Operation and maintenance instructions shall contain the following as a minimum:

1. Approved shop drawings and submittal data.
2. Model, type, size and serial numbers of equipment furnished.
3. Equipment and driver nameplate data.
4. List of parts showing replacement numbers.
5. Recommended list of spare parts.
6. Complete operating instructions.
7. Electrical schematics.
8. Factory and start-up and test data, including pump curves.
9. Service and Maintenance instructions.
10. Electronic files and annotated print copies of all PLC and HMI application programs, as commissioned.

1.2 MANUFACTURER QUALIFICATIONS

A. Single Source Responsibility

The entire pump station and the control panel shall be designed, assembled, programmed, and tested by a single manufacturer.

B. Safety Certifications

The manufacturer shall be a UL QCZJ Listed Packaged Pump Station Manufacturer, as well as a UL 508A Listed Control Panel Manufacturer.

C. Manufacturer Personnel

The Manufacturer shall employ service personnel who are trained and certified in every aspect of service that may be required on the pump station. It shall not be acceptable for the control panel to be designed, manufactured, programmed, or tested by any entity other than the Packaged Pump Manufacturer.

D. Approved Manufacturer

The pumping system shall be manufactured by a company regularly employed in the manufacturer of packaged pumping systems. Reference Section 00 20 13, Instructions to Bidders and Section 00 21 16.20, Supplemental Bidder's Responsibility Statement, for additional information.

1.3 REFERENCE STANDARDS

A. NEMA – National Electrical Manufacturers Association
B. NEC – National Electrical Code
C. UL – Underwriters Laboratories, Inc.
D. AWWA – American Water Works Association
E. NSF/ANSI 61– Drinking Water System Components
F. ANSI – American National Standards Institute
G. ANSI/HI – American National Standards Institute/Hydraulic Institute
H. ASTM – American Society of Testing & Materials

1.4 SYSTEM TYPE

A. Potable Booster Pump Station

1.5 SITE CONDITIONS

A. Electrical Input: 240Vac / 3 Phase / 60 Hz

1.6 PUMP DESIGN CRITERIA

A. Raw Water Pumps

1. Quantity: 2
2. Type: End-Suction Centrifugal
3. Nameplate Horsepower: 5 HP
4. Performance:
    a. Normal Demand: 200 GPM @ 50 feet TDH
5. Minimum Efficiency:
    a. Normal Demand: 73%
6. NPSH Required: 4 feet
7. Operation: Lead/Standby
8. Speed: 1750 RPM
9. Manufacturer: Goulds 16AI/BF or approved equal

B. Recirculation Pump

1. Quantity: 1
2. Type: Vertical Multi-stage
3. Nameplate Horsepower: 1.0 HP
4. Design Performance: 100 GPM @ 24 feet TDH
5. Minimum Efficiency @ Design: 72%
6. NPSH Required: 2 feet
7. Operation: Continuous 24/7
8. Speed: 1750 RPM
9. Manufacturer: Goulds 46SV_1 or approved equal

1.7 SYSTEM PROTECTIONS

A. The pump station shall include the following system protections, including at a minimum but not limited to:

1. Low Flow
2. High Flow
3. Low Suction Pressure
4. High Discharge Pressure

5. Low Tank Level
6. Electrical System Protections as described in Section 3.5

PART 2 PRODUCTS

2.1 PUMPS AND MOTORS

A. END-SUCTION CENTRIFUGAL PUMP

1. General Requirements. Each pump shall be a horizontally mounted, single stage, end-suction centrifugal pump. The pump shall be designed for continuous operating service and shall have a continuously rising performance curve. The pump(s) shall meet the design criteria on the Drawings.

2. Construction. The pump casing shall be constructed of close grain cast iron with replaceable wear ring. All casing sections shall have heavy wall thickness to provide long life under abrasive and corrosive operating conditions. Casing shall be capable of withstanding a hydrostatic pressure test of at least 125 percent of shutoff pressure or 150 percent of design head. Piping connections shall be ASA 125# flat face drilled flange. All pumps shall be of the back pull-out design so that the rotating element can be removed from the casing without disconnecting the suction or discharge piping.

3. Impeller. Pump impellers shall be constructed of bronze, fully machined on all exterior surfaces, and statically balanced.

4. Seal. Shaft seal shall be a mechanical seal with NI-resist stationary seat, carbon washer, Buna rubber flexible members, and 18-8 stainless steel metal parts and spring.

5. Manufacturer. Pumps shall be manufactured by Xylem, Inc., Cornell, or approved equal.

6. Motors:

    a. Motors shall be TENV, induction style, premium efficient, IEEE-814 rated suitable for constant speed operations.

    b. Motor frame shall be steel or cast iron, aluminum shall not be permitted.

    c. Motors shall be rated for operation at 208-240/480 VAC, 3-phase, 60 hertz, and service factor of 1.15 or greater.

    d. Motors shall be 3,600 RPM maximum and operate at standard RPM's as required by the pump or equipment which they drive.

e. The motor shall be of proper size to drive the pump at any point on the operation curve without exceeding the percent of the motor horsepower nameplate rating as called out in the Technical Specifications.

B. VERTICAL MULT-STAGE PUMP

1. Construction.

a. The pump casing shall be of deep drawn, laser welded AISI 304L stainless steel (optional cast iron) and shall be capable of withstanding maximum working pressures of 360 psi or 580 psi. Number based on pump staging and flange selection. Piping connections shall be in-line and shall be compatible with ANSI raised face flanges.

b. Wear rings composed of PPS shall be provided within each stage. Wear rings must be self-centering and easily replaceable. Impellers shall be of enclosed design and constructed of AISI 316L or AISI 304L stainless steel. Impellers shall provide internal thrust balance in each stage. Each stage shall have a bowl with attached diffuser and be constructed of AISI 304L or 316L stainless steel. The seal housing shall be of concave design and shall hold the seal faces below the topmost part of the pump casing. The pump shall have shaft sleeves made of Tungsten Carbide and ceramic bearings. Shaft height shall be set with a standard spacer. The mechanical seal shall be of the following components: Rotary Face: Carbon; Rotary Stationary Face: Silicon Carbide; Elastomer: Viton.

2. Pump Testing. Each pump shall be hydrostatically tested by the manufacturer in accordance with Hydraulic Institute Standards at a minimum of 1.5 times the operating pressure. Production performance testing will be conducted by the manufacturer on each pump unit. Head at three operating points (70% of BEP, BEP and 120% of BEP) will be measured to verify performance.

3. Manufacturer: Vertical Multi-Stage Pumps shall be manufactured by Goulds, Grundfos, or approved equal.

4. Motors:

a. The pump drive motor shall be NEMA standard design TC frame suitable for vertical mounting and close coupled to the pump unit.

b. Motors shall be of standard manufacturers catalog design and must not use special bearings as a thrust handling device.

C. Motor shall be Premium Efficient, TENV, IEEE-814 rated, with a 1.15 service factor.

2.2 PUMP STATION ENCLOSURE

A. The pump station enclosure shall be built out of marine grade aluminum, with all surfaces coated in thermosetting epoxy powder coating with a minimum thickness of 3 mils. The enclosure shall consist of a frame built out of structural folded aluminum. The enclosure frame shall be built to readily accept foil faced insulation. Aluminum panels to be mounted to enclosure frame with pan head torx tamper resistant stainless-steel screws. Enclosure shall consist of 2 hinged, lockable entry doors. Enclosure shall consist of a removable roof that shall be sloped to prevent moisture build up.

B. Enclosure Accessories

1. Insulation

The enclosure shall be insulated with rigid foam plastic thermal insulation board composed of polyisocyanurate foam core bonded to reinforced aluminum foil facers on each side. The insulation shall be 2″ thick, with an R-Value of no less than 12.9.

2. Heater

The enclosure shall be equipped with a 500-Watt radiant heater with stainless steel element, built-in snap-action thermostat, and steel housing with baked enamel protective coating. It shall come equipped with a capillary tube running the full length of the element to provide over-temperature protection, which shall automatically reset when temperature drops.

3. Electrical Outlet

The enclosure shall be equipped with a 120V electrical outlet in a waterproof enclosure.

4. Light

The enclosure shall be equipped with an LED work light.

2.3 STATION BASE, PIPING, & VALVES

A. Pump Station Base

The system base frame shall be constructed of 3/8″ steel plate per ASTM A36. The steel plate shall be press brake formed with a minimum riser height of 5 inches. Sub-structure supports shall be added as necessary using 3/8″ steel strap. Welded bases or open rail systems shall not be acceptable. The base frame shall be coated with thermosetting epoxy powder coating with a minimum thickness of 3 mils.

B. Piping, Fittings, & Connections

1. All piping, fittings, and pipe supports shall be constructed of ASTM A53-B STEEL, Schedule 40, rated CLASS D.

2. Manifolds shall be grooved or cope welded per AWWA standards. Threaded connections in the piping network are not acceptable. Grooved pipe connections shall be used where indicated on the drawings. All welded flanges shall be Class D forged stainless-steel slip-on or weld neck type. All welded fittings shall be seamless, conforming to ASTM Specification A234, with pressure rating not less than 150 PSI.

3. All process piping shall be coated both internally and externally with NSF-61 rated thermosetting epoxy powder coating, with a thickness of no less than 10 mils. Color to be selected by the Owner.

C. Valves

1. Butterfly Isolation Valves

Grooved butterfly valves furnished under this section shall be NSF/ANSI 61 approved for potable water applications. Valve body shall be ductile iron conforming to ASTM A536 and nylon coated. Valve disk shall be EPDM encapsulated ductile iron. Shaft shall be 416 stainless steel. Valves shall be rated for the system operating pressure. Grooved butterfly valves shall be Gruvlok Series 7700 or approved equal.

2. Check Valves

Check valves shall be of the silent type as specified in Section 40 05 23.24.

3. Air Release Valves

Air release valves shall be as specified in Section 40 05 23.72.

4. Rate of Flow Control Valves

Rate of flow control valves shall be as specified in Section 40 05 23.74.

D. Pressure Gauges

Pressure gauges shall be as specified in Paragraph 40 91 19-2.2, with a ¼” NPT pressure sensing connection.

E. Pressure Transmitters

Pressure sensor/transmitters shall be as specified in Paragraphs 40 91 19-2.3, 2.4 and 2.5, with pressure sensing connection as required by the instrument manufacturer.

2.4 MOTOR CONTROL PANEL (MCP)

A. General

1. The Motor Control Panel shall incorporate all circuits and necessary protections required to operate the pump station, including motors, controls, and heating and ventilation circuits. All wiring shall conform to NEC and UL 508A standards.

2. The control panel shall be designed, built, tested, and UL 508A listed by the pump station manufacturer. The control panel shall be UL labeled as an "Enclosed Industrial Control Panel". The pump control panel shall be completely manufactured, tested and programmed prior to delivery to the job site.

3. Electrical connection, by purchaser, shall consist of a single conduit from owners disconnect to the pump station MCC (Motor Control Center).

4. The following shall be permanently affixed to the inside of the control panel enclosure:

   a. A full-color, diagrammatic wiring schematic.
   b. Pump and motor nameplate information.
   c. Factory calibrated control setpoints.

B. Panel Construction

The pumping station electrical controls and operator interface, shall be provided as specified in Section 40 95 13.

C. MCP Temperature Regulation

The cooling system shall be sized for local maximum ambient conditions, plus component cooling requirements. Cooling should be designed such that the internal panel temperature does not exceed 104F.

D. Service Rated Main Disconnect

A three-pole, main station disconnect shall be contained within the control enclosure. The main disconnect shall be non-fused and isolate all power to the control enclosure. The main disconnect shall have an operating handle mounted in the enclosure door, mechanically interlocked to prevent entry while disconnect is in the ON position.

E. Pilot Devices

1. The control panel shall include the following pilot devices:

a. 3-Position Selector (HOA) Switches

b. Speed Potentiometer

c. Pilot Lights: A red light shall indicate system faults; a green light shall indicate pump is running.

2. Pump Status Indicator: Internal parameters of critical system operations must be viewable without opening the enclosure door.

F. Control Transformer

The control transformer shall provide 120-volt power to the pump station controls. The control transformer shall be protected on the primary side with appropriately sized fuses. Secondary side shall be protected by a group of supplementary miniature circuit breakers.

G. Secondary Control Circuit Breakers

Single-pole secondary distribution breakers with appropriate ratings shall supply power to each pump starter coil circuit, and control system.

H. Surge Protection

The control panel shall include an industrial surge protector.

2.5 PUMP SYSTEM CONTROLLER

A. General Requirements

1. Non-Proprietary, Open Source Programming

To better facilitate SCADA integration and owner access to system servicing, the control system shall be non-proprietary and open-source, with the complete system programming made available to the owner via USB drive. Proprietary control systems shall not be accepted.

2. Controller User Guide

The pump station manufacturer shall supply an owner's manual in digital form that includes graphic images of all touch screens, complete with explanations of all settings and modes.

3. Remote Monitoring and Control

   The control system shall be equipped with an Ethernet switch and wireless 4G modem, enabling the owner to remotely monitor and control the system via the internet.

4. SCADA Interface

   The pump control system manufacturer shall coordinate with the Contractor's System's Integrator to provide seamless data transfer between the new pump controller and the existing treatment facility SCADA control system PLC. The pump control system manufacturer shall provide application program information to the Contractor prior to system startup for the Systems Integrator's use. Any data transfer between the existing SCADA system and the new pump control system necessary for the proper operation of the pumping system shall be coordinated by the Contractor. The pump control system manufacturer shall provide all requested information to the Contractor in a timely manner.

B. Programmable Logic Controller (PLC)

   PLC shall be as specified in Section 40 93 43.

C. Human Machine Interface (HMI)

   The HMI shall be provided as specified in Paragraph 40 95 13-2.6.

D. Monitoring Functions

1. System Overview Screen

   a. Pump status, including lead pump designation and current draw.

   b. Alarm conditions, with the ability to manually reset alarms.

   c. Current values of all system sensors, including pressure and flow.

2. Fault Log

   The controller shall have a system fault log that displays the precise times of fault occurrences and recoveries, as well as message indicating the fault type. The fault log shall include a fault diagnosis utility that provides possible causes of and solutions to all system faults and warnings.

3. Trend Log

   Trend graphing screen capable of detailing pressure, flow, and current data. Graphing function shall give the option to graph and plot a point at user adjustable

intervals. All data shall be capable of being downloaded to a USB drive, and allow an operator to upload the data to a spreadsheet type program.

E. Control Functions

1. Pressure Settings

   Pressure transmitter calibration, discharge pressure setpoint, and high and low-pressure alarm/fault conditions.

2. Flow Settings

   Low and high flow alarm conditions, flow meter sensor calibration settings, and total gallons pumped with user reset button and time/date stamp of last reset.

3. Pump Settings

   Pump detail screens showing total run hours of each pump since last reset and any modes, options, or functions specific to that pump.

4. Pump Sleep Settings

   The pump shall enter sleep mode via user adjustable settings based on either of two thresholds: VFD frequency or system flow. The user shall also be able to adjust the sleep delay mode. The pump shall enter operating mode when the system pressure reaches a user adjustable “Wake-Up” pressure setting.

5. Remote Start/Stop Signal Relay

   The PLC shall be able to start and stop the system based on a remote signal relay.

6. Pre-programmed Start-Up Routines

   a. The PLC shall be programmed with various start-up routines that limit and/or delay the starting and acceleration of the pump—ensuring that excessive velocity and pressure do not damage the distribution system.

   b. The program shall include individual routines for initial start-up, mainline fill, re-start after a power outage, and re-start after a system fault.

   c. The operator shall be able to adjust the timing of the routines via the operator interface.

7. Password Protection

8. Loading and Saving System Default Settings

   The system shall allow the operator to Load Factory Default PLC settings, Save New Operator settings, and Load previously saved Operator PLC settings.

9. System Date and Time

   The PLC and HMI shall allow the operator to change the system date and time.

10. System Protections

    a. Controls shall shut down the pump station in the event of the alarm conditions described in this section, as well as otherwise indicated. The system controls shall attempt to restart the system after alarm shutdown or loss of power. After a user-adjustable number of attempts to re-pressurize the system, the controls shall go into hard shut down and remain so until manually reset.

    b. Low Flow Shutdown. The PLC shall automatically shut down the system if there is no, or too little flow, based on signals received from a flow switch. The low flow shutdown shall have a user adjustable time delay.

    c. Low Suction Pressure Shutdown. The PLC shall automatically shut down the system if the suction pressure reaches a user-adjustable pressure value. The low suction pressure shutdown shall have a user adjustable time delay.

    d. Low Level Shutdown. The controller shall automatically shut-down the system based on low level signals from a level transmitter.

    e. High Pressure Shutdown. In addition to the pressure data received from the pressure transmitter, the PLC shall automatically shut-down the system based on signals from a high-pressure switch.

    f. Electrical Fault Shutdowns. Incoming power high, low, and imbalance limits. Shut-down and restart time delays shall be user-adjustable.

    g. Analog Transmitter Failure. Input levels of all connected transmitters and meters shall be monitored for failures.

    h. Motor starter failure. Circuit breaker and/or motor overload contacts shall be monitored to indicate a motor failure.

PART 3 EXECUTION

3.1 ONSITE PUMP STATION START-UP

A. Technical start-up shall be furnished by the Packaged Pump Station Manufacturer or a qualified service agent. Location and mounting details shall be furnished by the Packaged Pump Station Manufacturer.

B. Electrical power connections, by purchaser, shall consist of conduit from the pump control panel to the pump station motor disconnect switches. Additional purchaser responsibility shall include confirming correct motor rotation and securing local inspection/approval. Signal and control connections shall consist of conduits and cables between the pump control panels and field devices within the pump station package.

C. Technical start-up procedures by the pump station technician shall include the following:

1. Station start-up and pressurization.

2. Pressure, flow, HMI (Human Machine Interface) and PLC (Programmable Logic Controller) programming adjustments.

3. Monitoring of complete operational cycle when possible.

4. Testing of all alarms and fault conditions.

5. Start up support for integrating the new pump control system into the existing treatment facility SCADA control system. The pump station technician shall work with the Contractor's Systems Integrator to pass all necessary data between the existing SCADA control system and the new pumping control system to provide a complete and working system.

6. Customer training and the presentation of the station operation and maintenance manual.

END OF SECTION

SECTION 33 13 00

TESTING & DISINFECTING OF WATER UTILITY PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes hydrostatic pressure testing, disinfection and purity testing of potable water systems piping, fittings, valves, and domestic water services.

B. Section Includes:

1. Pressure testing and disinfection of potable water distribution and transmission piping systems and appurtenances.

2. Testing and reporting of results.

C. Related Requirements:

1. Section 33 11 10 - Water Utility Distribution Piping.
2. Section 33 12 16 - Water Utility Distribution Valves.
3. Section 33 12 19 - Fire Hydrants.
4. Section 33 12 13 - Water Service Connections.

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA B300 - Hypochlorites.

2. AWWA B301 - Liquid Chlorine.

3. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.

4. AWWA C605 - Underground Installation of PVC and PVCO Pressure Pipe and Fittings.

5. AWWA C651 - Disinfecting Water Mains.

6. AWWA C655 - Field Dechlorination.

1.3 SUBMITTALS

A. Section 01 33 00 – Contractor Submittals: Requirements for submittals.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Pipeline Testing & Disinfection Plan: To be submitted for review and approval by the Engineer a minimum of one month before testing is to start. As a minimum, the plan shall include the following:

1. Testing schedule.

2. Hydrostatic Testing Plan:

   a. Narrative of the proposed process.
   b. Proposed equipment to be used.
   c. Disposal location for excess water used to fill mains.

3. Disinfection Plan:

   a. Narrative of the proposed process.

   b. Proposed chemicals and equipment (including list of all pumps and meters) to be used.

   c. Calculations for the amount of chlorine required to achieve required chlorine residual levels.

   d. Proposed method of mixing, injecting and distributing of chlorine solution throughout all portions of the new water system facilities.

   e. Proposed plan for testing chlorine levels throughout the length of pipeline.

4. Proposed testing locations.

5. Proposed plan for water conveyance, including flow rates.

6. Proposed plan for water control.

7. Proposed plan for water disposal, including flow rates. Include proposed plan for dechlorination of disinfection water, including discharge points.

8. Proposed measures to be incorporated in the project to minimize erosion while discharging water from the pipeline.

1.4 CLOSEOUT SUBMITTALS

A. Disinfection Report:

1. Type and form of disinfectant used.

2. Date and time of disinfectant injection start and time of completion.

3. Test locations.

4. Name of person collecting samples.

5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.

6. Date and time of flushing start and completion.

7. Disinfectant residual after flushing in ppm for each outlet tested.

1.5 QUALITY ASSURANCE

A. Perform Work according to AWWA C651.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. All test equipment, chemicals for chlorination, temporary valves, bulkheads, or other water control equipment and materials shall be determined and furnished by the Contractor subject to the Engineer's review. No materials shall be used which would be injurious to the construction or its future functions.

B. All temporary thrust restraint and equipment and facilities required for hydrostatic testing will be considered incidental.

C. As a minimum, furnish the following equipment and materials for the testing:

Amount	Description
2	Graduated containers approved by the Engineer.
1	Hydraulic pump approved by the Engineer with hoses, valves and fittings as needed and required for the testing and disinfection of the facilities.
1	High range chlorine test kit, as approved by Engineer, with digital readout. Range of detection shall be between 5 & 200 ppm. Accuracy of 3%.
2	Pressure gauges with pressure range at least 120% greater than the required maximum test pressure with graduations in two (2) psi increments. Gauges shall have been calibrated with 90 days of pressure testing.

2.2 DISINFECTION CHEMICALS

A. Chemicals:

1. Hypochlorite: Comply with AWWA B300.
2. Liquid chlorine: Comply with AWWA B301.

2.3 DECHLORINATION CHEMICALS

A. Chemicals:

1. Comply with AWWA C655.

PART 3 EXECUTION

3.1 HYDROSTATIC TESTING OF WATER PIPING

A. Make all necessary provisions for conveying water to the points of use and for the disposal of test water.

B. No section of the pipeline shall be hydrostatically tested until backfill has been placed, compacted and passed required density testing and all field-placed concrete or mortar has attained full strength.

1. At the Contractor's option, early strength concrete may be used when the full-strength requirements conflict with schedule requirements.

2. All such substitutions and installations shall be approved by the Engineer prior to installation.

C. Provide 72-hour notification to the Engineer and Owner prior to conducting hydrostatic testing.

1. Provide coordination and scheduling required for the Owner and Engineer to witness and provide necessary labor for operating Owner's existing system during hydrostatic testing and disinfecting procedures.

2. The Contractor shall not operate any part of the existing water systems.

D. Pipe Filling:

1. Fill pipes slowly from the lowest elevation to highest point along test section with potable water.

2. Take all required precautions to prevent entrapping air in the pipes.

3. Allow for natural absorption of water by the lining of the pipe to occur.

4. Apply specified test pressure by pumping.

E. Testing of Mains:

1. Ductile Iron: In accordance with AWWA C600.

2. PVC: In accordance with AWWA C605.

3. General:

a. Tests shall be conducted under a hydrostatic test pressure not less than 1.25 times the stated anticipated maximum sustained working pressure of the pipeline measured at the highest elevation along the test section and not less than 1.5 times the stated working pressure at the lowest elevation of the test section, minimum 150 psi, unless otherwise shown in the Drawings.

b. In no case shall the test pressure exceed the rated working pressure for any joint, thrust restraint, valve, fitting, or other connected appurtenance of the test section.

c. Testing shall be performed by applying the specified test pressure by pumping.

d. Once the test pressure has been attained, the pump shall be valved off.

e. The test will be conducted for a two-hour period with the allowable leakage not to exceed the value as calculated per the Allowable Leakage formula below.

f. During the test period, there shall be no appreciable or abrupt loss in pressure.

4. Allowable Leakage:

a. Flanged Joints: Pipe, fittings and valves with flanged joints shall be completely watertight. No leakage allowed.

b. Mechanical or Push-on Joints: Pipe, fittings and valves with rubber gasketed joints shall have a measured loss not to exceed the rate given in the following Allowable Leakage formula:

$$AL = \frac{LD(P)^{1/2}}{148{,}000}$$

In the above formula:

AL = Allowable leakage, in gallons per hour
L = Length of pipe tested, in feet

D = Nominal diameter of pipe, in inches
P = Average test pressure during the leakage test, in pounds per square inch.

5. Maintaining Pressure:

   a. During the test period, operate the pump as required to maintain pressure in the pipe within 5 psi of the specified test pressure at all times.

   b. At the end of test period, operate the pump until the specified test pressure is again obtained.

      1) The pump suction shall be in a clean, graduated barrel or similar device or metered so that the amount of water required to restore the test pressure may be accurately measured.

      2) Sterilize this makeup water by adding chlorine to a concentration of 25 mg/L.

   c. The Engineer will determine the quantity of water required to maintain and restore the required pressure at the end of the test period.

   d. Each hour's loss stands on its own and will not be averaged.

6. Defects, Leakage, Failure:

   a. If the test reveals any defects, leakage in excess of the allowable, or failure, furnish all labor, equipment and materials required to locate and make necessary repairs.

   b. Correct any visible leakage regardless of the allowable leakage specified above.

   c. All leaks shall be repaired in a manner acceptable to the Engineer.

   d. The testing of the line shall be repeated until a test satisfactory to the Engineer has been achieved.

3.2 DISINFECTION OF WATER PIPING

A. Disinfection shall be in accordance with the latest version of AWWA C651 following Engineer's acceptance of hydrostatic testing.

B. Chlorination by means of tablets or powders (calcium hypochlorite) placed in each length of pipe during installation is specifically prohibited.

C. Flush all foreign matter from the pipeline, branches and services.

1. Provide at no additional cost to the Owner, hoses, temporary pipes, ditches, etc., as required to dispose of flushing water without damage to adjacent properties.

2. Flushing velocities shall be at least 2.5 feet per second (fps).

3. For large diameter pipe where it is impractical or impossible to flush the pipe at 2.5 fps velocity, clean the pipe in place from the inside by brushing and sweeping, then flush the line at a lower velocity.

D. Chlorine Application:

1. Fill the test section of main from the lowest elevation and maintain a steady flow rate while injecting the water main with chlorinated water.

2. Flow (bleed) a blow-off, standpipe or hydrant at the water main's high point(s) to allow air to escape and ensure all interior pipe surfaces are wetted.

E. Chlorine Residual:

1. Measure chlorine residual with a high-range chlorine test kit at a point near to the injection point while filling the main.

2. Adjust the dose rate as necessary to maintain the target dose rate.

F. Potable water piping shall be disinfected with a solution containing a minimum 25 parts per million (ppm) and a maximum 50 ppm chlorine.

1. Once the main is completely filled with super-chlorinated water, measure the chlorine residual a minimum of once every 200 feet of main and once for each main branch, 2-inch service or as directed by the Engineer.

2. The chlorine solution shall remain in the piping system for a period of 24 hours, after which time the sterilizing mixture shall have a strength of at least 10 ppm of chlorine.

3. If check samples fail to produce acceptable results, the disinfection procedure shall be repeated at the expense of the Contractor until satisfactory results are obtained.

G. Flush piping, branches and services with municipal potable water until the chlorine residual is below 1.5 ppm and approximately the same as the source water.

1. There is no minimum flushing velocity for this step.

H. Disposal of any water containing chlorine shall be performed in accordance with the latest edition of AWWA C651 and C655, and all state or local requirements.

1. Disposal may be made into existing sanitary sewer systems providing approvals are obtained from the respective system owners.

2. Any chlorinated water discharged to open stream channels must be dechlorinated prior to discharge to levels acceptable by Washington State Department of Ecology (DOE).

3.3 DISINFECTION & TESTING OF WATER MAIN END CONNECTIONS AND TIE-INS

A. Disinfection of potable water piping and appurtenances at end connections and tie-ins to the existing system which are required to remain in service due to restrictions in allowable shutdown time shall be disinfected as described below.

B. Prior to connecting new potable water piping and appurtenances with existing piping and appurtenances, the interior of all new pipe, fittings, valves and appurtenances shall be swabbed or sprayed with a 1% to 5% percent calcium hypochlorite solution.

C. In accordance with AWWA C651, swabbing or spraying of connection piping is allowed only if the total length of piping is equal to or less than one pipe length (18 feet). All runs of new piping over 18 feet in total length will require hydrostatic pressure testing, flushing and disinfection as detailed elsewhere in this Section.

D. Following the disinfection procedures described above, connection of the new piping and appurtenances to the existing water system shall be made.

1. During the system startup, the Engineer and Contractor shall visually inspect all new fittings, piping, valves and appurtenances for evidence of leakage.

2. Any leakage observed during this period shall be promptly repaired by the Contractor, at Contractor’s expense, as required by the Engineer.

3.4 FIELD QUALITY CONTROL

A. Bacteriological Sampling and Testing:

1. The Owner will collect samples after the line is flushed in accordance with the latest edition of AWWA C651.

a. The locations for sample collection shall be at the sole discretion of the Owner and Engineer.

b. The chlorine residual must be below 1.5 ppm, or restored to the level maintained in the Owner’s distribution system, when the sample is taken.

2. Bacterial Testing: After completing the chlorination procedure, test the main according to the following:

    a. Bacterial Sampling

        1) Option A:

            a) Take an initial set of samples using sampling site procedures outlined herein.

            b) Resample after a minimum of 24 hours' time has elapsed using sampling site procedures outlined herein.

            c) Both sets of successive samples must pass for the main to be approved for service.

        2) Option B:

            a) Allow main to sit for a minimum of 24 hours without any water use.

            b) Using sampling site procedures outlined herein, collect two sets of samples a minimum of 15 minutes apart while the sampling taps are left running.

            c) Both sets of samples must pass for the main to be approved for service.

        3) Allow 24 hours for the test results for each sample set.

    b. Sampling Locations

        1) The Owner will take one bacteriological sample from the end of the main and on each branch.

        2) For long runs of main, at least one sample will be taken for every 1,200 feet of new main and as directed.

    c. Sample Testing

        1) The Owner will test the sample set for coliform bacteria and publish the test results within 24 hours.

    d. Evaluating the Test Results

        1) If one or more of the sample set tests positive for coliforms (fails), repeat chlorination and sampling processes specified herein after correcting the cause of the failure and as directed by the Engineer.

2) When two consecutive sample sets test negative (passing)for coliform bacteria, the bacterial testing is complete.

e. Completion of Bacterial Testing

1) Upon completion of bacterial testing, notify the Owner shall notify the Engineer and Contractor in writing that the testing is complete and the main is ready for tie-in.

f. Multiple Positive (Failing) Test Results

1) If sample sets continue to test positive for coliforms, the Engineer will determine how to proceed, up to and including repeating the chlorination procedure or rejecting the pipe.

3. Results of the bacteriological testing shall be satisfactory with the Washington Department of Health, Office of Drinking Water and/or other appropriate regulatory agencies, or disinfection shall be repeated by the Contractor.

B. Optional Sampling and Testing

1. If a pipeline is not promptly returned to service, the situation will be evaluated by the Owner to determine if the water quality may have been impacted and if additional testing as specified herein is warranted.

END OF SECTION

SECTION 33 13 13

DISINFECTION OF WATER UTILITY STORAGE TANKS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes methods of disinfecting water storage tanks for potable water.

B. Section includes:

1. Water storage tank disinfection.
2. Bacteriological testing.
3. VOC Testing

1.2 RELATED SECTIONS

A. Section 09 97 14 - Steel Water Storage Tank Painting.

1.3 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA C652 - Disinfection of Water Storage Facilities.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Disinfection Procedure:

1. Submit description of procedure, including type of disinfectant and calculations indicating quantities of disinfectants required to produce specified chlorine concentration.

2. Comply with Sections 3 and 4 of AWWA C652.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Certify that disinfectants meet or exceed AWWA C652 requirements.

E. Test and Evaluation Reports: Indicate results of bacteriological and residual chlorine laboratory test reports.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 QUALITY ASSURANCE

A. Perform Work in compliance with AWWA C652.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store disinfectants according to manufacturer's recommendations and in a cool, dry place away from combustibles such as wood, rags, oils, and greases.

C. Handle disinfectants according to manufacturer's safety precautions.

PART 2 PRODUCTS

2.1 DISINFECTANTS

A. Chlorine Forms: According to AWWA C652, Section 4.

1. Liquid chlorine.
2. Sodium hypochlorite.
3. Calcium hypochlorite.

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspection:

1. Conduct inspection of tank interior before beginning disinfection.

2. Verify tank is clean and free of polluting materials.

3. Verify tank piping and vent connections are properly made and clear of obstructions.

4. Verify all interior paint is thoroughly cured according to paint manufacturer's instructions.

3.2 PREPARATION

A. Furnish personnel working inside tank during disinfection with equipment to comply with Federal and State regulations for Work conducted in a hazardous atmosphere.

B. Coordinate with the Engineer and Owner for scheduling of disinfection activities.

1. The Owner may require up to one weeks' time following notice to supply water for filling of reservoir.

3.3 APPLICATION

A. Use Chlorination Method 2 for disinfecting tank in Section 4 of AWWA C652, generally detailed as followed:

1. Spray or brush a solution of 200 mg/L available chlorine directly on the surfaces of all parts of the storage facility that will be in contact with water when the storage facility is full to the overflow elevation.

2. The solution shall thoroughly coat all surfaces to be treated, including the inlet and outlet piping and shall be applied to any separate drain piping such that it will have available chlorine of not less than 10 mg/L when filled with water.

3. Disinfected surfaces shall remain in contact with the strong chlorine solution for at least 30 min.

4. Following the completion of the chlorination procedure, potable water shall be admitted, the drain piping purged of the 10 mg/L chlorinated water, and the storage facility filled to its overflow level.

B. A sample shall be taken by the Owner for microbiological analysis according to State Health Standards for potable water.

1. Contact the Engineer and/or Owner to arrange for samples to be taken for microbiological analysis.

2. Microbiological analysis must indicate that the water is free of coliform organisms before the facility can be put into service.

3. It will not be necessary to flush the reservoir or tank after the chlorine solution is applied by spraying or brushing providing a passing microbiological test is achieved.

C. When water samples fail to meet State Health Standards for potable water, perform corrective measures until water quality conforms to State Health Standards.

D. Any superchlorinated water shall be discharged through an approved connection to the public sanitary sewer system or shall be dechlorinated to limits acceptable by the Washington Department of Ecology (DOE) for discharge into the existing storm drainage system. If superchlorinated water is to be discharged into the public sanitary sewer system, notify the sewage treatment plant notifying the planned time, location, and quantity of discharge. No superchlorinated water shall be discharged into the storm drainage system or natural drainage way prior to approved dechlorination treatment.

3.4 VOC SAMPLING AND TESTING

A. After the disinfection testing procedures have been completed and before the reservoir is placed into service, water from the reservoir shall be collected and tested for Volatile Organic Compounds (VOCs). The sample station shall flushed with a minimum of 100 gallons of water prior to collection.

B. VOC sampling and sample delivery will be completed by the Owner. Testing shall be performed by a testing laboratory certified by the Department of Ecology.

C. VOC testing shall follow the Washington Department of Health, Water System Design Manual, Appendix H, “Guidance for Leachable Contaminants Testing Procedures”. The procedure shall be as follows:

1. Fill reservoir to twenty percent (20 %) of the tank volume
2. Water is to remain in the tank for a minimum of seven (7) days
3. Collect water samples for VOC analysis as described above

D. Results of VOC testing shall be submitted directly to the DOH regional engineer reviewing the project and shall not exceed the current Maximum Contaminant Level (MCL) for public drinking water.

E. Failed test(s) are to be corrected by the Contractor until passing tests are attained. All costs associated with follow-up testing, including disposal of contaminated water, re-disinfection, filling, sampling, and testing, shall be the responsibility of the Contractor.

END OF SECTION

SECTION 33 16 13.13

STEEL ABOVEGROUND WATER UTILITY STORAGE TANKS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

This Section defines the work required for design, fabrication, and erection of the 250,000 gallon ground supported welded steel reservoir. The work described in this Section includes the steel reservoir, hatches, ladders, piping, and other appurtenances and accessories. Earthwork, foundation construction, electrical, mechanical and yard piping, landscaping and provisions for other related project work is covered elsewhere in the specifications.

1.2 QUALIFICATION OF TANK CONTRACTOR

The Contractor's attention is directed to Instructions to Bidders for instructions for submitting a Statement of Qualifications to perform Tank construction work for this Project.

1.3 DESIGN

A. General

The ground supported steel reservoir and all appurtenances shall be designed in accordance with the latest edition of the American Water Works Association (AWWA) Standard for Welded Steel Tanks for Water Storage, ANSI/AWWA D100-11 except as herein modified by these specifications. The basis for design of this welded steel reservoir shall be in accordance with AWWA D100-11 Sec. 3. The reservoir shall be a ground supported welded steel reservoir with a rafter and hub sported roof as shown on the drawings

B. Design Loads

1. Seismic Loads

The ground supported steel reservoir and all related components shall be designed and constructed to resist all seismic forces under both full and empty conditions. Using the effective mass procedure of AWWA D100-11 Sec. 13.3.3.1 for Seismic Site Class D, the seismic design factors shall be applied as noted in Sheet S-1 of the Drawings.

The tank manufacturers Design Engineer shall also utilize site specific response spectra prepared for this project by Geotechnical Resources Incorporated to replace the seismic coefficient in accordance with AWWA D100-11 Sec. 13.3.3.2.2. The final tank design shall be based upon the most conservative value of the site-specific response spectra or the seismic coefficient.

2. Wind Loads

   The reservoir shall be designed to resist wind loading under both full and empty conditions. The design method shall be in accordance with the IBC- 2015 with the following factors applied:

   Wind Speed = 115 mph; Exposure C; Importance Factor, Iw = 1.15. Minimum wind load shall not be less than 18 pounds per square feet in accordance with AWWA D100.

3. Snow Loads

   Snow loads shall be determined in accordance with the requirements of "Snow Load Regulations and Engineering Practices – Washington State. For the county of Vader, the uniform ground snow load is 19 pounds per square feet.

C. Codes and Standards

In addition to compliance with the provisions of ANSI/AWWA D100-11, the reservoir and all associated accessories and appurtenances shall be designed and constructed in accordance with all applicable local requirements including the following Codes, Standards:

1. Washington State Building Code
2. Washington Occupational Safety and Health Code
3. Washington State Department of Health requirements for Water System Design

D. Physical Requirements

The reservoir shape shall be a ground supported welded steel reservoir with a rafter and hub supported roof as shown on the plans, with the following dimensional criteria:

1.	Capacity	250,000 gallons (below Overflow Elevation level)
2.	Normal High Water Level (NHWL)	13.5 Feet (above floor)
3.	Overflow Elevation	14 Feet (above floor)
4.	Wall Height	20 Feet
5.	Floor Slope	2 % (high point at tank center)
6.	Roof Slope	¾":12"
7.	Tank Diameter	55 Feet

Details of design and construction shall be such as to allow access to all surfaces for maintenance, cleaning and coating and to eliminate all moisture pockets. All welds shall

be “seal” welds. There shall be no open crevices caused by overlap of steel plate on a supporting member.

E. Reservoir Design by Supplier

It is anticipated that the reservoir supplier will bid based on the details and requirements provided in the construction documents. The supplied tank shall conform to the details shown and described unless ENGINEER approvals are made otherwise during the shop drawing review process.

F. Acceptable Tank Contractors

The Tank Contractor shall be a supplier normally involved in the design and manufacture of the type of reservoir structure specified.

G. Submittal Requirements

Where revisions to the design represented in the construction documents are approved by the ENGINEER, the reservoir supplier shall provide any and all design drawings required by the ENGINEER to clearly delineate all proposed details of construction. These shall include as a minimum but not be limited to plan, section and elevation views for the basic structure and shall include detail drawings for all proposed revised accessories and attachments. Detailed structural design calculations shall also be provided, signed by a Washington licensed Structural Engineer.

In addition, shop drawings shall be provided which illustrate the steel plate sizes and layout, and which distinguish all sizes and types of both shop and field welds. All components, which will be shop fabricated, shall be clearly identified. Shop drawings shall also be provided for all proposed accessories.

The Contractor shall provide a letter from the Reservoir Supplier who certifies conformance of the (ENGINEER approved) design and any changes and/or supplier designed additions with requirements of these specifications (unless otherwise approved) and all applicable codes and standards of the State of Washington. That letter shall include a summary of design data, which identifies live and dead design base loads for wind, snow and seismic loading. The calculated lateral force coefficient shall also be identified. If any Contractor initiated changes and/or additions are made to the original design, that letter, and the above described design drawings and structural calculations, shall have affixed thereto the current and valid Structural Engineer’s seal of an Engineer licensed to practice in the State of Washington. The ENGINEER reserves the rights to review and reject with proper cause all or portions of the submittal.

PART 2 MATERIALS

2.1 TANK AND ACCESSORIES

Tank and accessories shall be welded steel unless otherwise noted and approved in accordance with ANSI/AWWA D100-11. All tank steel shall be of sand blast quality and shall be free of surface pitting. Mill test certificates shall be provided for all steel components.

A Certificate of Compliance shall be provided with each lot of steel delivered to the project site, which certifies that all steel included in the delivery meets all requirements of the Specifications. Each certificate shall include the delivery date and shall clearly identify the material for which it applies, and the Contractor's representative responsible for checking the material. All materials proposed to be used may be required by the ENGINEER to be sampled and tested at any time. Any materials found to be in nonconformance with the Specifications will be rejected. The form of the Certificate of Compliance shall be as approved by the ENGINEER. Mill test certificates for corresponding steel components shall be attached to each Certification of Compliance.

2.2 TANK ACCESSORIES

The completed tank shall include all accessories shown on the drawings and described herein. All accessories shall be designed and constructed in accordance with all applicable Federal, State and local codes and standards.

A. Ladders – Fixed internal and external ladders shall be included, providing access from the ground level vertically along the tank shell to the roof edge, and from the access hatch at the roof edge to the reservoir bottom as shown on the drawings. All ladders shall be of steel fabrication as shown on the drawings and shall include a fall prevention system as per Section 11 81 29, Facility Fall Protection of the specifications. Ladders may be constructed in section lengths as determined by the Contractor.

B. Tank Bottom Access Hatches – Two 36-inch diameter hinged access hatches shall be provided through the tank shell to the tank bottom. Hatches shall be of watertight design and construction and shall be oriented as shown on the plans. Hatches shall be of design to provide positive seating when subjected to reservoir water head and shall be operable from the dry side of the tank shell.

C. Roof Hatch – A square or rectangular aluminum hinged access hatch shall be provided at the roof edge to allow access into the reservoir. The hatch shall be designed and constructed in accordance with AWWA D100-11 provisions. Hatch construction shall be of weatherproof design. A 4-inch high steel collar shall be welded to the reservoir roof from which the hatch shall be hinged. The hatch shall have sides which overlap the 4-inch collar by 2 inches and shall include handles welded both inside and out. Hinge design shall be such as to hold the hatch at approximately 90 degrees above the roof level when opened, providing easy closing and preventing damage to the tank

exterior coating during opening. The access hatch opening shall have a clear opening of 36 inches by 48 inches. Hatch shall be constructed to operate smoothly without binding. All sharp edges and corners shall be ground to a smooth chamfer. The hatch shall be equipped with an open position locking mechanism and a padlock hasp. OWNER will provide locks.

D. Roof Exhaust Manhole – A 24-inch diameter flanged steel exhaust manhole shall be provided on the tank roof as shown on the plans. The exhaust manhole shall be watertight and designed and constructed in accordance with AWWA D100-11 provisions. A 4-inch steel flanged collar shall be welded to the reservoir to which the manhole cover can be bolted. The manhole cover shall be equipped with two handles welded on the outside of the cover. All sharp edges and corners shall be ground to a smooth chamfer.

E. Tank Vent – The reservoir shall be vented through a vent mounted on the tank roof above the high-water level as shown on the plans. Tank vent shall be designed by the Manufacturer and approved by the ENGINEER. The vent shall be sized for adequate airflow at extreme tank fill/empty flow rates. Vent sizing shall be based on a minimum fill/empty flow rate of 15,800 gpm. Vent shall be fitted with stainless steel screening for insect and pest obstruction and shall be secured continuously around all edges. Screen securing system shall be such as to allow maintenance replacement of screen. Vent shall include a 48-inch diameter, 16 gage spun steel rainproof hood and shall be removable by means of a bolting system accessible and operable from the tank roof without the need for entry into the tank wet well.

F. Hand Rails – Permanently mounted OSHA approved handrails shall be provided as shown on the plans. See provisions of other sections of these specifications relating to handrails.

G. Overflow, Drain, Outlet and Inlet Pipes – Overflow, drain, outlet and inlet pipes shall be provided as shown on the plans. Water inlet and outlet piping shall be 10 inches in diameter. Reservoir overflow and drain piping shall be 4 inches in diameter. All steel piping shall be of extra strong pipe thickness with either flanged ends as per AWWA C207- (latest edition) or plain ends. The steel overflow, drain and outlet pipes shall be shop fabricated and coated inside and out according to the provisions of this document. The steel portion of the inlet pipe shall be shop fabricated and coated inside and out according to the provisions of this document. No field welding of pipe sections will be allowed except near ends where pipe can be readily prepared, primed, coated, and inspected without remote equipment. Where field welds must be made to connect the piping to the tank, the primer and paint shall be held back a minimum of 6-inches with the hold back distances being staggered for each layer of primer/paint. Upon completion of the pipe connecting welds the unpainted sections of pipe shall be primed and painted inside and out according to the provisions of this document. All pipe supports and/or other attachments shall be fabricated and welded to pipe

sections prior to interior pipe coating. Overflow piping shall be fully supported as shown on the drawings. Provisions covered elsewhere in these specifications for piping shall apply to this section.

H. Painter's Couplings and Lug – Painters couplings and lug shall be provided as generally shown on the plans. Design and construction shall be of Manufacturer's standard design. All painters' accessories shown are minimum requirements. The Contractor shall satisfy themselves as to the adequacy of shown accessories for specific construction operations. No representation is made as to the structural capacity of these accessories. The Contractor may propose, under the discretion of the ENGINEER, alternate accessories to facilitate specific construction operations as may be deemed necessary.

I. Drip Eave/Overhang – Perimeter drip eave and overhang shall be provided around roof edge as shown on the plans.

J. Lightning Grounding – Provide lightning grounding of steel reservoir structure as required by National Electrical Code (NEC) and the county of Lewis, electrical permit requirements.

K. Roof Rafters and Hub – Provide design of roof rafters, central column mounted hub, and wall and hub connections. Maximum rafter spacing along the exterior of the reservoir is 4'-6". Connections and hub shall be designed to withstand design loads. The roof rafter shall be fully seal welded along its top flange to the roof plate.

L. Identification Plate – A tank identification plate shall be mounted near the south tank bottom access hatch. The identification plate shall be corrosion resistant and contain the following information:

- Tank Contractor
- Tank Contractor's project or file number
- Tank capacity
- Height to High Water Level
- Date erected

PART 3 EXECUTION

3.1 GENERAL

All workmanship required for the fabrication and erection of the steel tank structure and all accessories shall be of the highest quality. All work shall conform to the standards set forth in AWWA D100-11 except as modified herein. The steel tank structure and all integral accessories and components shall be the end product of one manufacturer. The structure shall be constructed to true, plumb and concentric lines and dimensions.

3.2 STANDARDS

All construction shall be in full conformance with all applicable Federal, State, and Local codes, standards and specifications including those set forth by the American Water Works Association (AWWA), American Welding Society (AWS), the American Institute of Steel Construction (AISC), American Society for Testing and Materials International, (ASTM International) and the Occupational Safety and Health Administration (OSHA)

3.3 FABRICATION AND ERECTION

A. Reservoir Foundation – A concrete foundation shall be constructed beneath the reservoir in accordance the provisions stated elsewhere in these specifications.

B. Perimeter Seal – A continuous perimeter seal of 1-inch thick nonshrink grout shall be provided between the top of the concrete ringwall foundation and the underside of the reservoir in accordance with Section 12.6.1 of AWWA D100-11.

C. Plate Forming – All single radius plates shall be cold rolled to the appropriate design diameter resulting in a continuous smooth radius. Double curved plates shall be press formed. Mortar and pestle dishing will not be allowed. Field hammering or any other method of plate adjustment which may cause marring or unsightly deformation will not be allowed. Any plates which do not meet the tolerance requirements set forth in AWWA D100-11and as further described herein shall be rejected and replaced.

D. Welding – All welds shall be “seal” welds. All circumferential and longitudinal steel plate shell welds shall be full penetration butt welds except as described as follows. Circumferential lap welds will be allowed only on the roof portion of the tank. Any overlap of plates shall be seal welded to prevent moisture pockets. All exposed sharp edges, burrs and corners shall be ground smooth. All weld splatter shall be removed by grinding. Any and all welds not uniform and continuous shall be ground smooth.

E. Matching Plates – In addition to the requirements of the AWWA D100-11Sec. 10.8, deviations at welded joints shall not exceed 1/8 of an inch from the true curve shape. The Contractor shall provide any and all field jigs as may be required for checking joint tolerances. Any plates or sections of plates not meeting these requirements shall be rejected and replaced.

F. Inspection and Testing – Inspection of shop forming, surface preparation and welding procedures may be conducted by the ENGINEER or the ENGINEER’s agent. The Contractor shall provide the ENGINEER with a schedule identifying all planned shop fabrication activities. The quality of welded joints shall be determined by the radiograph method as specified in AWWA D100-11 Sec. 11. The Contractor shall provide all necessary radiographic testing equipment and shall perform any and all tests as may be required by the ENGINEER. All radiographic films shall become the property of the OWNER. Initial field-testing will be conducted immediately following

the beginning of field welding operations and inspection of radiographs will be made to establish the acceptable quality of work.

The Contractor shall provide and submit a written report as per the requirements of AWWA D100-11Sec. 11.2.1 Radiographic methods shall be used for testing of all welds where possible. The Contractor shall notify the ENGINEER 24 hours in advance of any scaffolding relocation and shall provide ample opportunity for any and all testing and inspections as may be required by the ENGINEER.

Following completion of tank erection, and prior to tank coating, the reservoir shall be leakage tested in accordance with the requirements of AWWA D100-11Sec. 11.12. The OWNER shall provide water for initial testing of the reservoir. Water as may be required for subsequent tests shall be purchased by the Contractor. Disposal of water shall be through the overflow and drain piping system constructed as part of this project.

G. Painting and Disinfection – Painting and disinfection shall be accomplished in accordance with requirements included elsewhere in these specifications.

H. Post Fabrication & Erection Cut-Outs – Special cut-outs within a fabricated steel panel for the temporary purpose of moving equipment into, out of, or off of the steel tank structure will not be allowed. Any requirements shall be accommodated by either postponing installation of a particular panel or by cutting out and rewelding an entire fabricated steel panel section at pattern layout seams. The intent of this specification is to preserve the aesthetic appearance of symmetrical and uniform fabricated panel layouts and weld seams. It is not the intent of this specification to restrict the Contractor's use of external crane equipment for purposes of removing or installing equipment from or into the structure.

3.4 SUBMITTALS

The Contractor shall submit information provided by the Reservoir Contractor as identified below. The submittal shall be presented in the form of a bound portfolio. All items shall be included in this single submittal package of which six copies shall be provided.

A. Letter Certifying Design Compliance for all elements (approved by the ENGINEER) varying from the details included in the construction documents and/or not included in the construction document.

B. Design drawings for varying details and/or details not included in the construction documents – Plan, sections, elevations and details, including all accessories shall be stamped by a Washington State licensed Structural Engineer unless otherwise approved. Supporting calculations stamped by a Washington State licensed Structural Engineer are also required.

C. Shop Drawings – Include plate layout and steel thicknesses for basic structure indicating which sections are to be shop fabricated and which are to be field fabricated. Shop drawings shall include: weld locations, types and sizes, fabrication details of all required components and accessories, support details for all pipes and conduits, and any other information as may be required by the ENGINEER.

D. Joint Tolerance Jigs – As per Paragraph 3.3 “Fabrication and Erection”, Subparagraph E “Matching Plates” -- provide shop drawings.

E. Radiographic Weld Testing Equipment – Submit manufacturer and model of equipment proposed to be used for testing of weld joints; include detailed outline description of equipment operation and testing evaluation methods.

END OF SECTION

SECTION 40 05 23.15

GATE VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes gate valves for use in buried service and utility vaults. Coordinate with Section 33 12 16, Water Utility Distribution Valves.

B. Section Includes:

1. Resilient-seated gate valves.

1.2 RELATED SECTIONS

A. Section 33 12 16, Water Utility Distribution Valves.
B. Section 33 11 10, Water Utility Distribution Piping.

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.

2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.

3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

4. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

B. ASTM International:

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

3. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. American Water Works Association:

1. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.

2. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.

3. AWWA C550 - Protecting Interior Coatings for Valves and Hydrants.

D. National Sanitation Foundation International:

1. NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects
2. NSF/ANSI Standard 372 - Drinking Water System Components - Lead Content

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. As required by Section 33 12 16 – Water utility Distribution Valves.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 RESILIENT-SEATED GATE VALVES

A. Description:

1. Comply with AWWA C509 or AWWA C515.

2. Minimum Pressure Rating:

a. 12-inch Diameter and Smaller: 200 psig.
b. 16-inch Diameter and Larger: 150 psig.

3. End Connections: As shown in the Drawings.

a. Standard mechanical joint ends comply with ANSI/AWWA C111.

b. Flanged end dimensions and drilling comply with ANSI/ASME B16.1, class 125. Comply with AWWA C115 & ASME 16.5.

1) The Contractor shall coordinate with pipe, valve and fitting suppliers to make certain pipe, valve and fitting flanges match in bolt pattern.

4. Gear Actuators: Conforming to AWWA C509 for manual valves.

5. Linings and Coatings:

a. Corrosion-resistant fusion bonded epoxy conforming to AWWA C550 and NSF 61.

b. All internal and external ferrous surfaces.

c. Do not coat flange faces of valves.

6. Bi-directional flow.

B. Operation:

1. Non-rising stem.

2. Open counterclockwise when viewing the valve from above, unless otherwise indicated in the Drawings.

3. Buried Valves: All buried valves shall be provided with 2-inch square operating nuts.

4. In-Plant Service Valves: Valves for in-plant or exposed service shall be furnished with handwheel operators, unless otherwise specified in Section 40 05 23, Common Work Results for Process Valves.

C. Materials:

1. Wedge:

a. ASTM A126, cast iron or ASTM A536, ductile iron.
b. Fully encapsulated with molded rubber.

2. Body and Bonnet:

a. ASTM A126, cast iron or ASTM A536, ductile iron.

3. Stem, Stem Nuts, Glands, and Bushings: ASTM B584, bronze.

4. Valve Body Bolting: Stainless steel.

D. Manufacturers:

1. Clow Valve Company.
2. M&H Valve.
3. U.S. Pipe.
4. American Flow Control.
5. Mueller Company.

2.3 SOURCE QUALITY CONTROL

A. Testing: Test gate valves according to AWWA C509.

PART 3 EXECUTION

3.1 INSTALLATION

A. As required by Section 33 12 16, Water Utility Distribution Valves.
B. Install according to manufacturer's instructions.
C. Support valves in plastic piping to prevent undue stresses on piping.

END OF SECTION

SECTION 40 05 23.24

CHECK VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Work in this Section includes check valves for use in water and wastewater facilities. Work includes the furnish and install of all swing and silent check valves, complete, as shown on the Drawings and specified herein, including coating and lining, appurtenances, operators, and accessories.

B. Section includes:

1. Swing check valves, 1-inch through 4-inch diameter.
2. Swing check valves, 4-inch diameter and larger
3. Tilting disc check valves.
4. Silent check valves.
5. Plastic check valves.

1.2 RELATED SECTIONS:

A. Section 33 12 16 - Water Utility Distribution Valves

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.
3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings.

B. ASTM International:

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. ASTM A536 - Standard Specification for Ductile Iron Castings.

3. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

4. ASTM B148 - Standard Specification for Aluminum-Bronze Sand Castings.

5. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

6. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.

7. ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.

8. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

C. American Water Works Association:

1. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.

D. National Science Foundation:

1. NSF 61 - Drinking Water System Components - Health Effects.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

PART 2 PRODUCTS

2.1 SWING CHECK VALVES, 1-INCH THROUGH 4-INCH DIAMETER

A. Description:

1. Horizontal T-pattern style.

2. 200# WOG.

3. Capable of functioning in the vertical position.

4. Connections shall be standard threaded or threaded for fire hose connections where shown on plans

B. Materials:

1. Body Cap and Disc: Brass conforming to ASTM B584 C85400.

C. Manufacturer:

1. Figure 246 as manufactured by Red White Valve.

2.2 TILTING DISC CHECK VALVE

A. Description:

1. The valve shall be of the tilting disc type consisting of a circular disc with a conical rim, hinged about a fixed point above its centerline and offset from the plane of the seat, which seats against a body seat clamped between two valve body sections.

2. The body shall be ductile iron conforming to ASTM A536 grade 65-45-12 with integral flanges faced and drilled to ANSI B16.42 Class 300. A port shall be provided in both body sections to provide visual access upstream and downstream of the disc. Bosses shall be provided on the top and bottom of the valve for the installation of hydraulic dashpots.

3. The two body halves and body seat shall be O-ring sealed and bolted together in a manner to sandwich the body seat on a 55° angle. The set ring and disc ring must be of the design that permits replaceability in the field without need for special tools or machining. The pivot pins in the body and the bushings in the disc lugs must be stainless steel, conforming to ASTM A582 T303, but of different hardness to prevent galling. The bushings shall stainless steel conforming to ASTM A269 T304 and are to be press fit to prevent wear.

4. The disc shall be solid bronze alloy C90700 in sizes up to 10”. In sizes 12” and above the disc shall be ductile iron conforming to ASTM A536 with bronze seat and bronze bushings conforming to ASTM B16 C36000. The area throughout the valve body must be equal to full pipe area. The area through the seat section shall be 40% larger than the inlet and outlet of the valve to achieve low head loss. Provide visual position indication.

5. Provide an oil hydraulic bottom buffer to dampen the final portion of valve closure. Buffer shall be self-contained and incorporate an air gap to preclude hydraulic oil from entering the valve housing. The buffer shall be designed to contact the disc during the last 10% of closure and control the final closing of the valve to prevent water hammer. The rate of closure to be externally adjustable and variable. The line media to the buffer must be separated by a combination pressure sensing device, oil-water separator to protect the buffer cylinder against corrosive build-up from the media.

6. The valve shall swing open smoothly at pump start and close quickly upon pump shutdown to prevent flow reversal. The bottom buffer shall dampen the final portion of the closing stroke to prevent slam and bang.

7. Working pressure: 150 psi.

B. Finishes:

1. Furnish check valves with NSF 61 approved liquid epoxy lining and coating conforming to AWWA C550.

C. Manufacturers:

1. Apco Series 800 Slanting Disc Check Valve.
2. VAG model SKR.
3. Approved equal.

2.3 SILENT CHECK VALVES

A. Description:

1. Type: Globe-style, silent operating type that begins to close as the forward velocity diminishes and be fully closed at zero velocity, preventing flow reversal and resultant water hammer or shock.

2. Valve design shall incorporate a center-guided, spring-loaded poppet, guided at opposite ends and having a short linear stroke that generates a flow area equal to the pipe.

3. Valve Interior: Contoured and unrestricted to achieve maximum flow capacity along with minimum pressure drop.

4. Installation: Operation of the valve shall not be affected by the position of installation. It shall be capable of operating in the horizontal or vertical position with the flow op or down.

5. Valve Disc: Concave to the flow direction providing for disc stabilization, maximum strength and minimal flow velocity to fully open the valve.

6. All component parts shall be field replaceable without the need of special tools.

7. A replaceable guide bushing shall be provided and held in position by the valve's spring.

8. Spring: Designed to withstand 100,000 cycles without failure and exert a force which allows the valve to start opening at a differential pressure of .5 PSI (.04 KG/CM2) and to fully open at a flow velocity of 4 FPS (1.22 meters per second).

9. The valve disc and seat shall be field replaceable and have a seating surface finish of 32 micro-inch or better to insure positive seating at all pressures.

10. Valve shall be hydrostatically tested at 1.5 times the rated working pressure.

11. Working Pressure: 150 psi.

12. End Connections: As shown on Drawings. End connections shall be rated to the working pressure requirements specified above.

B. Materials:

1. Body: ASTM A536, ductile iron.
2. Trim: Stainless steel.
3. Spring: Stainless steel.
4. Resilient Seat: Buna-N

C. Finishes:

1. Epoxy lining and coating conforming to AWWA C210.

2. For potable water service, epoxy lining and coating shall meet be provided with NSF 61 certification.

D. Manufacturer:

1. Val-Matic, 1800 series.
2. Cla-Val, 581 series.
3. Approved equal.

2.4 SOURCE QUALITY CONTROL

A. Testing:

1. Hydrostatically test check valves at twice rated pressure, in conformance with requirements of AWWA C508.

2. Permitted Leakage at Indicated Working Pressure: None.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install check valves according to AWWA C508, Section 40 05 23 Common Work Results for Process Valve, and as recommended by manufacturer.

3.2 SERVICES PROVIDED BY MANUFACTURER'S REPRESENTATIVES

A. Provide the services of the valve manufacturer's representative to verify proper installation of the valves and to adjust the valves when construction is complete.

END OF SECTION

SECTION 40 05 23.72

MISCELLANEOUS VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes miscellaneous valves not included in other Sections for use in buried service and utility vaults.

B. Section Includes:

1. Air release valves.
2. Combination air/vacuum valves.
3. Ball valves, 2 inches and under.

1.2 RELATED SECTION

A. Section 05 50 00, Metal Fabrications.
B. Section 09 90 00, Painting and Coating.
C. Section 33 11 10, Water Utility Distribution Piping.
D. Section 33 12 16, Water Utility Distribution Valves.

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.

2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.

3. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.

4. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

5. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

B. ASTM International:

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. ASTM A536 - Standard Specification for Ductile Iron Castings.

3. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

1.4 COORDINATION

A. Contractor shall be solely responsible to coordinate Work of this Section with piping, equipment, and appurtenances.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit manufacturer's latest published literature. Include illustrations, installation and maintenance instructions, and parts lists.

2. Submit valve cavitation limits.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit installation instructions and special requirements, including storage and handling procedures.

E. Lining and coating data.

F. Valve Labeling Schedule: Indicate valve locations and nametag text.

G. Certification of Valves Larger than 12 inches: Furnish certified copies of hydrostatic factory tests, indicating compliance with applicable standards.

H. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

I. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections, including factory-applied coatings.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and actuators.

B. Operation and Maintenance Data: Submit information for valves.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. Furnish one set of manufacturer's recommended spare parts.

B. Tools:

1. Furnish special wrenches and other devices required for Owner to maintain equipment.

2. Furnish compatible and appropriately labeled toolbox when requested by Owner.

1.8 QUALITY ASSURANCE

A. Cast manufacturer's name, pressure rating, size of valve and year of fabrication into valve body.

B. Valve Testing: Each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

C. Certification: Prior to shipment, submit for all valves over 12 inches in diameter, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc. Valves tested and supplied shall be trackable and traceable by serial number, tagged or otherwise noted on valve, upon arrival to Site.

D. Maintain clearances as indicated on Drawings.

E. Unless otherwise noted, all water works materials provided for the Project shall be new, of first class quality and shall be made by reputable manufacturers.

F. All material of a like kind shall be provided from a single manufacturer, unless otherwise approved by the Engineer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

1. Store materials in areas protected from weather, moisture, or other potential damage.

2. Do not store materials directly on ground.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.

3. Provide additional protection according to manufacturer instructions.

D. Handle products carefully to prevent damage to interior or exterior surfaces.

E. All defective or damaged materials shall be replaced with new materials at no cost to the Owner.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the "lead free" requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for "lead free".

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 AIR RELEASE VALVES

A. Description:

1. Inlet Size: 2-inch diameter and smaller.
2. Cast-iron body & cover. Comply with ASTM A126, Class B.
3. Stainless steel orifice and float. Comply with ASTM A240.
4. Design test pressure: 450 psig.

B. Manufacturers:

1. DeZurik - APCO Series 200A or approved equal.

2.3 COMBINATION AIR/VACUUM VALVES

A. Description:

1. Construction: Single combination air/ vacuum release valve
2. Inlet Size: 2-inch diameter.
3. High-strength composite body
4. Valves seats: corrosion resistant materials

B. Manufacturers:

1. ARI – D040 or similar, approved equal

2.4 BLOW-OFF HYDRANT ASSEMBLIES

A. Description:

1. Material: 100% low-lead brass.

2. Inlet: 2-inch diameter FIP vertical straight inlet.

3. Outlet: 2-inch diameter MIP.

4. Operation:

a. By turning a top-mounted square operating nut.
b. Operation must seal drain outlet in all positions from 1/4-open to fully open.

5. Hydrant shall be non-freezing, self-draining.

6. Accessories: Provide Owner with (1) operating wrench.

B. Manufacturers:

1. Kupferle – Truflo #TF500 or approved equal.

2.5 FLAP VALVES

A. Description:

1. Material: ASTM A126, cast iron.
2. Seat and hinge pin: Bronze.
3. End connection: 125 pound flange, unless otherwise noted on the Drawings.
4. Two pivot points.
5. Valves 14-inches and smaller shall have the hinge pin secured with cotter pins.
6. Valves 16-inches and larger shall have the hinge pin secured with nuts.

B. Manufacturers:

1. M & H, Style 47 or approved equal.

2.6 BALL VALVES, 2 INCHES AND UNDER

A. Description:

1. 400 lb. WOG with bronze body and trim, unless otherwise shown on the Drawings.

2. Seat ring: TFE.

3. O-ring seals: Fluorocarbon.

4. Three-piece construction so that maintenance can be performed without distributing the valve body after installation.

B. Manufacturer:

1. Nibco T-590-Y or equal.

2.7 SOURCE QUALITY CONTROL

A. Testing Pressure-Reducing and Pressure-Sustaining Valves:

1. Leakage Testing:

a. Test each assembled valve hydrostatically at 1-1/2 times rated working pressure for minimum five minutes.

b. Test each valve for leakage at rated working pressure against closed valve.

c. Permitted Leakage: None.

2. Functional Testing:

a. Test each valve to verify specified performance.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install valves per manufacturer requirements and recommendations.

B. Install all valves with valve seats level.

C. Install protective strainers upstream of solenoid valves, pressure-reducing valves, and pressure-sustaining valves.

END OF SECTION

SECTION 40 05 23.74

PRESSURE REDUCING VALVES

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section includes pressure reducing valves, complete and operable, including coatings and linings, appurtenances, operators, and accessories, in accordance with the requirements of the Contract Documents.

1.2 RELATED SECTIONS

A. Section 33 12 23, Water Utility Pumping Stations.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. In accordance with Article 1.03, Reference Specifications, Codes, and Standards of Section 33 12 16, Water Utility Distribution Valves - General.

1.4 SUBMITTALS

A. As required by Section 01 33 00, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. As required by Section 33 12 16, Water Utility Distribution Valves – General.

PART 2 PRODUCTS

2.1 PRESSURE REDUCING VALVES

A. Size: As shown on the Drawings.

B. Construction:

1. Valve shall be single-seated, globe style, hydraulically operated and diaphragm actuated.

    a. Diaphragm assembly shall be guided top and bottom by a precision-machined stem.

    b. Resilient valve disc, retained on three sides by disc retainers, shall form a drip-tight seal with a renewable seat when pressure is applied above the diaphragm.

c. Control of valve operation shall be by means of an externally mounted, hydraulic pilot system.

d. Reduced internal port.

2. Main Valve Body and Cover: ASTM A536 ductile iron.

3. End Connections: Flanged or Grooved.

4. Pressure Rating: ASME/ANSI B16.42 Class 150.

5. Main valve trim shall be stainless steel.

6. Pilot control components: Bronze ASTM B62 with Type 303 stainless steel trim, and pilot tubing shall be copper.

7. Rubber parts shall be Buna-N synthetic rubber.

C. Protective Coating:

1. Valve body and cover shall be lined and coated with an FDA approved fusion bonded epoxy coating system suitable for use with ductile iron.

2. The epoxy coating thickness and application shall be in accordance with AWWA C550.

D. Operating Requirements

1. Pressure Reducing Control:

a. A pressure reducing control, located in the pilot system, shall sense the main valve outlet pressure, and shall cause the main valve to modulate (open and close) as required to maintain a constant pressure at the main valve outlet at all times.

b. Adjusting the spring force in the pressure reducing control shall set the desired constant pressure.

E. Accessories: The following accessories shall be furnished with all pressure reducing valves:

1. Self-cleaning strainer for pilot system.

a. H-Style strainer.

b. Ductile iron body.

c. Manufacturer:

1) Model X43H as manufactured by Cla-Val Co., Newport Beach, CA, or approved equal.

2. Pilot system isolation valves on inlet, outlet, and cover lines.

3. Inlet and outlet pressure gauges installed on valve.

a. Inlet pressure gauge: Use discharge pressure gauge to be included with pump station.

b. Outlet pressure gauge: Range, 0 - 30 psi.

4. Pressure reducing control.

a. Spring range: 2 - 30 psi. Set at 15 psi +/-.

5. Opening speed control.

6. Closing speed control.

7. Valve position indicator.

F. Valve Model & Manufacturer:

1. Model 690G-01 pressure reducing valve as manufactured by Cla-Val Co., Newport Beach, CA, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Valve installation shall be in accordance with manufacturer's requirements.

3.2 SERVICES PROVIDED BY MANUFACTURER'S REPRESENTATIVES

A. Provide the services of the valve manufacturer's representative to verify proper installation of the valves and to adjust the valves when construction is complete.

END OF SECTION

SECTION 40 90 00

GENERAL INSTRUMENTATION AND CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. This section covers all work necessary for furnishing, installing, adjusting, testing, documenting, and starting-up the Instrumentation and Control (I&C) system for the Vader – Enchanted Valley Reservoir Project.

B. Major elements of this system include, but are not limited to, all materials, equipment, and work required to implement a complete and operating system as described herein. The system shall include primary elements for process variable measurements, process display, control elements and all hardware and software required for the pumping system controller and integration of the new equipment into the City's existing PLC and SCADA systems. The Contractor shall coordinate all necessary programming updates to the existing SCADA control system by the Systems Integrator and the new pumping control system as specified in Division 33.

1.2 DEFINITION OF TERMS

A. System Integrators: A firm who shall design and furnish the system, assemble the instrument panels and program new PLCs, HMIs, SCADA computers and all other instrument components, modify programs as necessary for the City's existing systems and provide start-up and training services. Display all new pumping system equipment status, process variable values and alarms on the existing treatment facility SCADA HMI. Coordinate with the pumping control system manufacturer to pass all necessary data between the existing and new controllers to facilitate a complete and working system.

B. CONTRACTOR: The CONTRACTOR, as distinct from the System Integrator, shall install the panels, and other materials furnished by the System Integrator and provide all additional materials and work necessary and thereby, satisfy all requirements that are within the scope of this section. The Contractor shall be responsible to coordinate all work between the packaged equipment suppliers and the Systems Integrator.

1.3 QUALIFIED SYSTEM INTEGRATORS

The I&C system provided as part of this contract is an addition to and a modification to the City of Vader's existing reservoir pumping system. For compatibility with their comprehensive system, I&C design and system integration shall be provided by system integrators with at least 5 years' documented experience on water infrastructure projects of

similar size, scope and complexity. The system's integrator shall have completed at least 2 successful projects within the past two years.

1.4 STANDARDS

A. NEC - National Electrical Code, NFPA No. 70.

B. ISA - Instrument Society of America

C. ICS - NEMA (National Electrical Manufacturer's Association) Industrial Control and Systems including:

1. ICS-1 General Standards for Industrial Control and System.
2. ICS-2 Standards for Industrial Control Devices, Controllers and Assemblies.
3. ICS-3 Industrial Systems.
4. ICS-4 Terminal Blocks for Industrial Control Equipment and Systems.
5. ICS-6 Enclosures for Industrial Controls

1.5 SPECIAL REQUIREMENTS

A. The CONTRACTOR shall install components including those assembled and programmed by the System Integrator at the locations shown on the plans.

B. The System Integrator shall make all final power and signal connections to all Telemetry equipment provided under this section.

C. The CONTRACTOR and System Integrator shall participate in the testing of all Control panels and I&C field devices at start-up.

1.6 SUBMITTALS

A. Hardware Submittals

In addition to the requirements stated elsewhere in these documents, the following information shall be provided:

1. 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.

2. Description and operation of all remote site hardware and the configuration features of the I/O and local control loop characteristics.

3. Catalog information, descriptive literature, wiring diagrams, and shop drawings on all controllers, recorders, indicators, transmitters, primary elements, gauges, and all other components of the system.

4. Individual data (or specification) sheets shall be provided for all components provided under this section. The purpose of these data sheets is to supplement the generalized catalog information provided by citing all specific features for each specific component (e.g., scale range, materials of construction, special options included, etc.). Each component data sheet shall bear the component name and instrument tag number designation.

5. Catalog information on all electrical devices furnished under this section.

6. Shop drawings and catalog material for all control panels and enclosures.

7. Panel elementary diagrams of prewired panels. Show all switched analog signals and all auxiliary devices such as relays, terminals, alarms, fuses, lights, fans, heaters, etc.

8. Interconnecting wiring diagrams, showing all components and panel terminal board identification numbers and external wire numbers. This diagram shall include all intermediate terminations between field elements and panels (e.g. terminal junction boxes, motor control centers, etc.). This diagram shall be coordinated with the electrical contractor and shall bear his mark showing that this has been done. Diagrams, device designations, and symbols shall be in accordance with NEMA ICS 1-101.

B. System Drawing Submittals

Following approval of the Hardware Submittal, the System Integrator shall prepare complete system interconnect wiring diagrams and panel layout drawings for approval. Thirty (30) days shall be allowed for this purpose.

C. All submittals shall be complete, neat, orderly, and indexed. Partial submittals will not be accepted.

1.7 DOCUMENTATION

A. Documentation for the complete Instrumentation and Control system shall be provided. This documentation shall include Operation and Maintenance Manuals and Record Drawings:

1. Operating and Maintenance Manuals

a. Provide five (5) complete sets of loose-leaf Operation and Maintenance Manuals. These manuals shall not only include descriptive material, but also drawings and figures bound in appropriate places.

b. The manuals shall include operating and maintenance literature for all components provided in this section. The submitted literature shall be in

sufficient detail to facilitate the operation, removal, installation, adjustment, calibration, and maintenance of each component provided under this section.

2. Record Drawings

Final as-built drawings (22" by 34" and 11" x 17" reduced) of equipment shall be provided and as a minimum include:

a. Overall dimension details for each equipment and all door mounted operator devices including nameplate designations.

b. Interconnecting wiring diagrams of all equipment, including the control panels, field device connections, and other system equipment.

c. Control loop flow charts showing operation of the system.

1.8 QUALITY ASSURANCE

A. The CONTRACTOR shall cause the System Integrator and other suppliers of all I&C equipment specified or referenced herein to coordinate design of the I&C system such that all equipment is compatible and capable of achieving the performance requirements specified herein.

B. The CONTRACTOR shall be ultimately responsible and shall provide for all labor, equipment, and materials not supplied by the System Integrator which are necessary for the supply, installation, adjustment, and start-up of a complete coordinated system which shall reliably perform the specified functions.

1.9 TRAINING

Training shall comply with Division 1 specification requirements. Provide 1 day of training for two of the OWNER's personnel in the operation and maintenance of reservoir pumping I&C system. Satisfactory completion of this requirement shall be determined by the OWNER and ENGINEER.

PART 2 PRODUCTS

2.1 GENERAL

A. The I&C System is designed to function as an integral part of the OWNER's existing PLC and SCADA system in place at the facility and shall provide all the functions described herein and shown on the drawings. The Contractor shall provide services of a qualified Systems Integrator to modify the City's existing control and SCADA systems to fully integrate the new Pump Station control system specified in Section 33 12 23. The

Contractor shall coordinate all work between the Systems Integrator and Pump Station System Supplier to provide a complete and working system

B. Analog signals shall be 4 to 20 mA DC and shall conform to the compatibility requirements of ISA Standard S50.1. Unless otherwise noted, circuits shall be Type 2 two-wire. Transmitters shall have a load resistance capability conforming to Class L. Transmitters and receivers shall be fully isolated.

C. Discrete signals are two-state logic signals of two types: control and alarm. Control and alarm signals shall utilize 24 VDC sources. All alarm signals shall be normally closed, open to alarm isolated contacts rated for 5 amperes at 24 VDC.

D. Nameplates are defined as inscribed laminated plastic plates mounted under or near a panel face mounted instrument. Service legends are defined as inscribed laminated plastic integrally mounted on a panel face mounted instrument.

E. Service legends and nameplates shall be engraved, rigid, laminated plastic type with adhesive back. Unless otherwise noted, color shall be black with white letters and letter height shall be 3/8-inch high characters.

2.2 FIELD INSTRUMENTS

A. General

1. The major field instruments to be provided as part of the reservoir pumping I&C system are shown on the P&ID drawing. Some instruments listed are specified elsewhere in the Contract Documents as part of other equipment. All items of equipment required to complete the I&C system and to achieve the required performance shall be provided by the CONTRACTOR whether specified, listed or not.

2. The following are detailed instrumentation component specifications. Should the CONTRACTOR select other equipment, which is approved by the ENGINEER, that requires different installation requirements, wiring and conduit, enclosures, accessories, etc., the CONTRACTOR shall obtain approval from the ENGINEER for such changes to the design and shall make all approved changes at the CONTRACTOR’s expense.

PART 3 EXECUTION

3.1 GENERAL

A. Install materials and equipment in a workman-like manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance.

B. Coordinate Instrumentation and Control work with the System Integrator, OWNER, CONTRACTOR and work of other trades to avoid conflicts, errors, delays and unnecessary interference with system operations during construction.

C. Installation requirements for control valves, motor controls, electrical materials and other equipment not specified within this section are specified in sections specific to that equipment.

3.2 COORDINATION WITH SYSTEM INTEGRATOR

A. The CONTRACTOR shall coordinate directly with the System Integrator to insure all requirements within the scope of this Section are satisfied.

B. System Simulation

To the degree possible, the entire instrumentation and control system shall be simulated at the System Integrator's facility. The ENGINEER, CONTRACTOR and OWNER personnel shall be invited to witness simulation and approve test results prior to shipment to CONTRACTOR.

C. Supervision of System Installation

The CONTRACTOR shall be responsible for installing both the pre-assembled system cabinets and other components which are to be mounted separately. In addition to providing the drawings and specifications for the system, System Integrator shall provide instructions to the installers, and prior to power up, shall verify installation is correct.

D. Schedule

System integration work shall begin upon receipt of approved Hardware Submittals. Delivery to the CONTRACTOR of completed panels and any system elements shall be made to meet CONTRACTOR’s schedule but not less than thirty (30) days following System Integrator's receipt of all materials required. Field acceptance tests shall be completed within thirty (30) days following installation by the CONTRACTOR.

3.3 PROTECTION DURING CONSTRUCTION

A. Throughout this Contract, the CONTRACTOR shall provide protection for materials and equipment against loss or damage and the effects of weather. Prior to installation, store items in indoor, dry locations. Provide heating in storage areas for items subject to corrosion under damp conditions. Specific storage requirements shall be in accordance with the manufacturer's recommendations.

3.4 MATERIAL AND EQUIPMENT INSTALLATION

A. Follow manufacturer's installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between manufacturer's instructions and these Contract Documents, follow ENGINEER's decision, at no additional cost to the OWNER. Keep copy of manufacturer's installation instructions on the jobsite available for review.

3.5 TESTING AND START-UPS

A. A witnessed FUNCTIONAL ACCEPTANCE TEST shall be performed on the complete system of Instrumentation and Controls. Each function shall be demonstrated to the satisfaction of the ENGINEER on a loop-by-loop basis. The actual testing program shall be conducted in accordance with the prior approved procedures, and shall be witnessed and signed off by both the CONTRACTOR and the ENGINEER upon satisfactory completion.

B. All special testing materials and equipment required shall be provided by the CONTRACTOR. Where it is not practical to test with real process variables, provide suitable means of simulation. These simulation techniques shall be subject to the approval of the ENGINEER.

C. Coordinate all testing with other associated suppliers and subcontractors.

D. The CONTRACTOR shall notify the ENGINEER at least two weeks prior to the date of the FUNCTIONAL ACCEPTANCE TEST. Acceptance tests shall be performed as described elsewhere in these specifications.

END OF SECTION

SECTION 40 91 19

LIQUID PRESSURE PROCESS MEASUREMENT DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pressure gages.
2. Pipeline pressure sensors.
3. Transmitters.

B. Related Requirements:

1. Section 26 00 05 – Electrical Methods and Materials.
2. Section 33 11 10 – Water Utility Distribution piping.
3. Section 33 12 23 – Water Utility Pumping Stations
4. Section 43 21 00 – Liquid Pumps.

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME B40.100 - Pressure Gauges and Gauge Attachments.

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 COORDINATION

A. Coordinate Work of this Section with pipeline work.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's Product Data for system materials and component equipment, including connection requirements.

C. Shop Drawings:

1. Indicate system materials and component equipment.
2. Submit installation requirements and other details.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for closeout procedures.

B. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for maintenance materials.

B. Extra Stock Materials:

1. Gages other than Diaphragm-Protected: Furnish 20 percent spare gages, with a minimum of one gage for each range used.

2. Diaphragm-Protected Gages: Furnish 20 percent spare gages, with a minimum of one gage for each range used, complete with diaphragm seals.

C. Tools: Furnish special wrenches and other devices required for Owner to maintain devices.

1.7 QUALITY ASSURANCE

A. Ensure that materials of construction of wetted parts are compatible with process liquid.

B. Perform Work according to manufacturer’s standards.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 10 00 – Summary of Work: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept equipment on-Site in manufacturer's original packaging and inspect for damage.

C. Store equipment according to manufacturer's instructions.

1.10 WARRANTY

A. Furnish five-year manufacturer's warranty for pressure-measurement devices.

PART 2 PRODUCTS

2.1 DESCRIPTION:

A. Furnish gages, sensors, field preamplifiers, signal conditioners, offset and span adjustments, amplifiers, transducers, transmitters, control devices, and unit conversions and algorithms as required for application.

2.2 PRESSURE GAGES

A. Manufacturers:

1. Ashcroft Duragauge Figure 1279
2. Ametek 1981L
3. Substitutions: Approved equal.
4. Furnish materials according to manufacturer’s standards.

B. Type: Compound.

C. Dials:

1. Nominal Diameter: 4-1/2 inches.
2. Face: White, laminated plastic dials with black graduations.
3. Scale: Extend over arc not less than 270 degrees.
4. Ranges and Graduation Units: As indicated on the Drawings.

D. Cases:

1. Silicone Liquid-filled.

2. Material: Phenolic.

3. Type: Blowout protected.

4. Blowout Disc Encasement Material: Steel.

5. Provide removable rear plate.

6. Windows:

    a. Material: Clear, shatterproof glass.
    b. Thickness: 1/8 inch.
    c. Provide gasket.

E. Connection:

1. Location: Bottom or Back.

2. Socket:

    a. 1/4-inch NPT male thread.
    b. Material: Brass forging.
    c. Extend minimum 1-1/4 inches below gage cases.
    d. Provide wrench flats.

3. Mounting: Stem, MBR manufacturer's standard.

F. Measuring Element:

1. Bourdon Tubes:

    a. Material: Stainless steel brazed to brass socket.
    b. Provide welded, stress-relieved joints.

2. Movement:

    a. Rotary geared.
    b. Material: Stainless steel.

3. Accuracy:

    a. Comply with ASME B40.100.
    b. Plus, and minus 0.5 percent of full-scale.

G. Adjustment:

1. Provide for zero-reading adjustment.
2. Adjusting Screws: Accessible from rear of case without need for disassembly.

H. Accessories:

1. Pressure Snubber:

a. Material: Type 316 stainless steel.
b. Provide isolation valve.

2. Shutoff Cocks: Furnished by gage manufacturer.

2.3 PRESSURE SENSORS

A. Manufacturers:

1. Endress and Hauser Cerabar
2. Rosemount 3051.
3. Substitutions: Approved equal.

B. Description: Flow-through, flange-mounted element to measure pressure exertion.

C. Materials:

1. Flanges: Type 316 stainless steel.

2.4 PRESSURE TRANSMITTERS

A. Description:

1. Excitation:

a. 9 to 30 V dc.
b. Overvoltage protected.

2. Accuracy: Plus, or minus 0.25 percent.

3. Output Signal: 4 to 20 mA dc.

4. Operating Temperature Range: Minus 40 to plus 185 degrees F.

5. Response Time: Less than 1 ms.

6. Materials: Type 316 stainless steel.

7. Static Pressure Rating: 2,000 psi.

B. Mounting: By Pump Supplier.

C. Furnish cable, field preamplifiers, and signal conditioners as required to maintain accuracy from transducer to terminal device.

2.5 OPERATION

A. Control Power:

1. Wiring: As specified.
2. 24-volt DC loop powered.
3. Furnish local transformers as required.

B. Enclosures: NEMA 6.

2.6 SOURCE QUALITY CONTROL

A. Section 01 75 16 - Testing, Training & System Startup: Requirements for testing, inspection, and analysis.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 33 00 - Submittal Procedures: Requirements for installation examination.

B. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.2 INSTALLATION

A. Coordinate location and orientation of gages and seal assemblies with final piping and equipment installations.

B. Ensure that gages are located to be easily read during operation and easily accessible for maintenance.

C. Mount only one pressure element per diaphragm seal.

D. Installation Standards: Install Work according to manufacturer’s standards.

3.3 FIELD QUALITY CONTROL

A. Section 01 75 16 - Testing, Training & System Startup: Requirements for inspecting and testing.

B. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than one day on-Site for installation, inspection, field testing, and instructing Owner's personnel in maintenance of equipment.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified, and rerun tests.

2. Make final adjustments to equipment under direction of manufacturer's representative.

D. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 DEMONSTRATION

A. Section 01 75 16 - Testing, Training & System Startup: Requirements for demonstration and training.

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION

SECTION 40 91 23.36

LEVEL PROCESS MEASUREMENT DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. This section specifies requirements for process level transducers, associated devices, and accessories.

B. Section Includes:

1. Hydrostatic-level measurement devices.

C. Related Requirements:

1. Section 26 00 05 – Electrical Materials and Methods.

1.2 REFERENCE STANDARDS

A. International Electrotechnical Commission:

1. IEC 61511 - Corrigendum 1 - Functional safety - Safety instrumented systems for the process industry sector.

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 COORDINATION

A. Section 01 10 00 - Summary of Work: Requirements for coordination.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's Product Data for system materials and component equipment, including connection requirements.

C. Shop Drawings:

1. Indicate system materials and component equipment.
2. Submit installation requirements and other details.
3. Wiring diagrams for signal connections.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 33 00 - Execution and Closeout Requirements: Requirements for closeout procedures.

B. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01 33 00 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Spare Parts:

1. Furnish one set of manufacturer's recommended spare parts.

C. Tools: Furnish any special devices required for Owner to maintain devices.

1.7 QUALITY ASSURANCE

A. Ensure that materials of construction of wetted parts are compatible with process liquid.

B. Perform Work according to manufacturer’s standards.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 10 00 - Summary of Work: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept equipment on-Site in manufacturer's original packaging and inspect for damage.

C. Store equipment according to manufacturer's instructions.

1.10 WARRANTY

A. Furnish five-year manufacturer's warranty for level measurement devices.

PART 2 PRODUCTS

2.1 DESCRIPTION:

A. Furnish sensors, signal conditioners, offset and span adjustments, amplifiers, transducers, transmitters, control devices, and unit conversions and algorithms as required for application.

2.2 HYDROSTATIC-LEVEL MEASUREMENT DEVICES

A. Manufacturers:

1. Mercoid Series PBLT2
2. Substitutions: Approved equal.

B. Sensor:

1. Description: Pressure sensor, condensate proofed and long-term stable, and incorporating continuous temperature and pressure compensation.

2. Power Supply: 24-volt DC loop powered.

3. Signal Output: 4-20 milliamperes into 0 t0 550 ohms.

4. Measuring Cell:

a. Hermetically sealed.
b. Material: 316 SS
c. Accuracy: Plus, or minus 0.25 percent of full scale

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 75 16 - Testing, Training & System Startup: Requirements for installation examination.

B. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.2 INSTALLATION

A. Coordinate location and orientation of level probe assemblies with final equipment installations.

B. Ensure that instruments are located to be easily accessible for maintenance.

C. Installation Standards: Install Work according to manufacturer’s standards.

3.3 FIELD QUALITY CONTROL

A. Section 01 75 16 - Testing, Training & System Startup: Requirements for inspecting and testing.

B. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than one day on-Site for installation, inspection, field testing, and instructing Owner's personnel in maintenance of equipment.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified, and rerun tests.

2. Make final adjustments to equipment under direction of manufacturer's representative.

D. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 DEMONSTRATION

A. Section 01 75 16 - Testing, Training & System Startup: Requirements for demonstration and training.

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION

SECTION 40 94 43

PROGRAMMABLE LOGIC PROCESS CONTROLLERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Programmable controllers and accessories.

B. Related Requirements:

1. Section 26 05 90 – Electrical Work, General.
2. Section 40 95 13 – Process Control Panels and Hardware.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

1. NEMA IA 2.2 - Programmable Controllers - Equipment Requirements and Tests.
2. NEMA IA 2.3 - Programmable Controllers - Programming Languages.
3. NEMA ICS 3 - Industrial Control and Systems: Factory Built Assemblies.
4. NEMA ICS 6 - Industrial Control and Systems: Enclosures.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit catalog data for each component showing electrical characteristics and connection requirements.

C. Shop Drawings: Indicate electrical characteristics and connection requirements, including layout of completed assemblies, panel wiring, field termination interconnections, network cabling, dimensions, weights, and external power requirements.

D. Qualifications Statements:

1. Submit qualifications for manufacturer and supplier.
2. Submit manufacturer's approval of supplier.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Project Record Documents: Record actual locations of controller cabinets and input and output devices connected to system. Include interconnection wiring and cabling information, and terminal block layouts in controller cabinets.

C. Test and Evaluation Reports: Indicate procedures and results for factory and field testing and inspection.

D. Manufacturer Reports: Indicate activities on-Site, adverse findings, and recommendations.

E. Operation and Maintenance Data: Submit bound copies of operating and programming instructions, and include card replacement, adjustments, and preventive maintenance procedures and materials.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Spare Parts: Furnish one spare processor module, communications module, I/O module, chassis power supply and backplane chassis for each unique PLC component type installed.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience, and with service facilities within 200 miles.

B. Supplier: Authorized distributor of specified manufacturer with minimum five years' documented experience.

1.7 AMBIENT CONDITIONS

A. Section 01 10 00 - Summary of Work: Requirements for ambient condition control facilities for product storage and installation.

B. Conform to specified service conditions during and after installation of programmable controllers.

C. Maintain area free of dirt and dust during and after installation of products.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Configuration: Networked programmable controller incorporated into reservoir pump system control panel for controlling tank level and bypass flow.

B. Equipment: Equipment and/or products shall be new and unused at the time of system assembly.

2.2 PROGRAMMABLE CONTROLLER

A. Manufacturers:

1. Rockwell Automation CompactLogix
2. Substitutions: Approved equal only.

B. NEMA IA 2.3 and IEC 61131-3 compliant program editor with program written in Ladder Logic, or Function Block Language. Program to be written using the same type of software as is specified below.

C. Networking Connections:

1. Provide all communication interfaces, network cables, taps, terminators, power supplies, and accessories for a complete Ethernet/IP operating network.

D. Processor:

1. With Ethernet port and serial port, minimum 200k bytes (8 bit) for IEC 1131 control programs, and 24k words (16 bit) for storage of data in battery-backed RAM memory. Provide additional serial communications adapters required for other serial interfacing. Include real-time clock.

E. Input and Output Modules:

1. Discrete Inputs: 24 Vdc, 16 channel.

2. Discrete Outputs:

a. Relay output, 16 channel isolated.

3. Analog Inputs:

a. 4-20 mAdc/1-5 Vdc, isolated channel-to-channel, 4 channel.

4. Analog Outputs:

a. 4-20 mAdc, isolated channel-to-channel, 4 channel.

5. I/O module terminations:

    a. By Manufacturer to match module.

6. I/O module interface modules:

    a. Provide as necessary including cabling to interface all I/O to processor.

7. Spare Input/Outputs:

    a. As shown in I/O listing.

F. Power Supplies:

1. 24 Vdc. Refer to Section 40 95 13 for power supply.

G. Miscellaneous:

1. Provide all cables, taps, terminators, power supplies, and accessories for a complete operating PLC system.

H. Programming Language: Conform to NEMA IA 2.3.

I. Programming Software: Furnish one each licensed copy application development and network communications module applications in the Owner's name for PLC programming and troubleshooting for use with general purpose microcomputer and Microsoft Windows 10 operating system. Programming software shall be by the same manufacturer as the PLC equipment.

1. RSLogix 5000 and RSLinx
2. Approved equal only

J. Networking Connections: EtherNet TCP/IP.

K. Spare Input/Output Capacity: 25 percent.

L. Input Voltage: 24 volts, DC.

M. Enclosure: NEMA ICS 12; Type 12 Coated Steel.

2.3 SOURCE QUALITY CONTROL

A. Section 01 75 16 - Testing, Training & System Startup: Requirements for testing, inspection, and analysis.

B. Testing: Test programmable controller according to NEMA IA 2.2.

PART 3 EXECUTION

3.1 PREPARATION

A. Section 01 33 00 - Submittal Procedures: Requirements for installation preparation.

B. Detail shop drawings showing field connections and any terminal block jumpering required.

C. Terminate all used and spare I/O wiring to terminal blocks.

D. Create wire markers with “to-from” component name, PLC slot/base, or terminal column number and terminal number information identical at each end.

E. Provide terminal blocks for field connections to PLC Discrete Inputs with 25 percent spare.

F. Provide terminal blocks for field connections to PLC Discrete Outputs with 25 percent spare.

G. Provide terminal blocks for field connections to PLC Analog Inputs with 25 percent spare.

H. Provide terminal blocks for field connections to PLC Analog Outputs with 25 percent spare.

3.2 INSTALLATION

A. Do not install products until major construction is complete and building interior is enclosed and heated.

B. Connect input and output devices.

C. Install engraved plastic nameplates according to Section 26 05 53 - Identification for Electrical Systems.

D. Ground and bond programmable controllers according to Section 26 05 26 - Grounding and Bonding for Electrical Systems.

3.3 FIELD QUALITY CONTROL

A. Section 01 75 16 - Testing, Training & System Startup: Requirements for inspecting and testing.

B. Equipment Manufacturer: The supplier of each PLC system shall provide a qualified service representative to perform the following:

1. Inspect the PLC installation including I/O and network systems, hardware configuration switch and jumper settings.

2. Monitor all PLC system diagnostic indicators, both hardware and software, and certify that the PLC system performance meets or exceeds the Manufacturer's published specifications.

3. Assist in all testing. The Systems Integrator will provide a minimum of three man-days on-site for each PLC logical rack.

4. Modify PLC programs as required.

5. Certify in writing to the Project Representative that the PLC system has been installed and configured in accordance with the Manufacturer's published guidelines.

C. Perform operational testing on control systems to verify proper operation and field wiring connections.

D. Manufacturer's Field Services: Prepare and start up programmable controller.

3.4 DEMONSTRATION AND TRAINING

A. Furnish 6 hours of instruction each for up to two sessions, to be conducted at the Project Site with manufacturer's representative for the Owner's personnel.

3.5 MAINTENANCE

A. Furnish service and maintenance of programmable controllers for three years from date of Substantial Completion.

3.6 PLC INPUT/OUTPUT SUMMARY

A. Submit a Programmable Logic Controller I/O Summary listing of PLC module requirements, and the assigned input/output points for the specified PLC system. The unassigned PLC I/O points shall be tagged as spare. I/O required by devices internal to the PLC control panel, shall be assigned to available I/O, while maintaining the required number of spare points.

END OF SECTION

SECTION 40 95 13

PROCESS CONTROL PANELS AND HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. This section specifies requirements for panels, cabinets, consoles, termination cabinets, and 19-inch electronic racks for instrument, control, and communication equipment for the Vader Reservoir Project including power disconnect, tank level and bypass flow process control, Human Machine Interface (HMI), push buttons, indicating lights, and control relays.

B. Related Sections:

1. Section 26 00 05 – Electrical Methods and Materials.
2. Section 26 05 90 – Electrical Work, General

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA ICS 6 – Industrial Control and Enclosures

B. Underwriters' Laboratories

1. UL 508A - Industrial Control Panels.

2. UL 94 – Tests for Flammability of Plastic materials for Parts in Devices and Appliances

3. ANSI/UL 497-1995 – Standard for Protectors for Paired Conductor Communications Circuits

4. UL 1012 – Power Supplies

5. UL 1449 – Surge Protective Devices

C. National Fire Protection Association

1. NFPA 79 – Electrical Standard for Industrial Machinery
2. NFPA 70-2017 - National Electric Code (NEC)

D. Electronic Industries Alliance

1. EIA RS-310C – Racks, Panels and Associated Equipment

1.3 PERFORMANCE REQUIREMENTS

A. Panel Design:

1. PLC hardware and software is specified in other Sections within Division 40.

2. Panel containing 120-volt powered equipment shall use the din-rail power distribution method with fuses and blown fuse indication. Power is restricted to 240 Vac and 24 Vdc.

3. Panels containing direct current powered instruments or serving as the termination point for transmission loop powered field instruments shall contain direct current power supply system as specified herein.

4. Provide the instrument, control, and monitoring features as specified. Panels shall be arranged to separate control and instrument devices from power wiring.

5. Panel shall be arranged for dedicated field wiring terminations rated for 600 VAC or less for power, control, and instrument signal wiring, in accordance with NEC Article 409. It shall be fabricated by a UL-508A recognized facility and shall bear the appropriate UL 508A Industrial Control Panel label. Panels shall be labeled in accordance with Article 409 of the National Electrical Code.

6. Transmitters, Analyzers, signal conditioning modules and other equipment or devices as specified in other Division 40 sections.

7. Panels that contain human machine interface (HMI) units shall be as specified. Specific panel devices are specified herein.

8. HMI shall comply as specified herein. Panels that do not comply with the specified products and specified logic method, hardwired or PLC logic, shall not be accepted. Cost to retrofit the panel as specified shall be borne by the Pumping System Supplier. Corrections or modifications to UL 508A Industrial Control Panels shall be transported to the panel supplier’s facility for corrections, testing, relabeling and inspection.

9. Field modifications require a UL inspector site inspection for approval of panel corrections and to re-label the panel after the field modifications are completed.

10. The Manufacturer package equipment and Contractor custom field panels shall adhere to the requirements in specifications Section 26 09 16 for motor starters,

controllers, and devices and the circuits shall be arranged for Fail-Safe wiring and electrical operation, as defined hereinafter.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Submit complete bill of materials, wiring diagrams and panel layout drawings showing dimensions to devices.

C. Product Data: Submit catalog information and descriptive literature for components.

D. Test Reports: Submit certified factory test report indicating control panel successfully performs functions specified.

E. Manufacturer's Installation Instructions: Submit instructions on installation and field wiring connections.

F. Manufacturer's Certificate: Written certification all Products meet or exceed specified requirements.

G. Manufacturer's Field Reports: Submit certification after installation that control panel has been installed in accordance with the PLC, HMI and Instrumentation Manufacturers' instructions and has been successfully field tested.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Project Record Documents: Record actual locations of control panel and final wiring diagrams and connections.

C. Operation and Maintenance Data: Submit operation and maintenance instructions for components and devices.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with UL 508A.

B. Provide components compatible with functions required to form complete working system. Equipment and components shall be Underwriters Laboratory (UL) listed for the purpose or UL recognized.

C. The control panels shall have factory applied UL 508A labels in accordance with NEC Article 409.

D. Perform Work in accordance with State of Washington Department of Building Codes standard.

E. Maintain at least one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer and Fabricator: Company specializing in manufacturing and assembling products specified in this section with minimum five years documented experience.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 10 00 - Administrative Requirements: Pre-installation meeting.
B. Convene minimum 4 weeks prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 10 00 - Summary of Work: Requirements for transporting, handling, storing, and protecting products.

B. Inspect for damage.

C. Store in areas protected from weather, moisture, or possible damage; do not store directly on ground; handle to prevent damage to wiring and components.

1.10 COORDINATION

A. Section 01 10 00 - Summary of Work: Requirements for coordination.

B. Coordinate work and component requirements with Plant Operations.

1.11 EXTRA MATERIALS

A. Section 01 33 00 - Submittal Procedures: Requirements for extra materials.

B. Furnish the following spare parts:

1. 5 pilot light bulbs.
2. 1 24-volt DC power supply for each size utilized.
3. 10 fuses for each type and size utilized.
4. 1 general purpose relay for each type utilized.

PART 2 PRODUCTS

2.1 PUMP CONTROL PANELS

A. Manufacturers:

1. Pump System Supplier only.
2. Substitutions: Not Permitted.

2.2 COMPONENTS

A. Control Panel Enclosure:

1. Furnish NEMA 250 Type 4X enclosure fabricated of 10 gage type 316L Stainless Steel with continuously welded seams.

    a. Enclosure door gasketed with neoprene.
    b. Heavy-duty three-point latching mechanism.
    c. Power: 240-volt, 3-phase.

2. Identify control panel components with engraved nameplate mounted on inside of panel.

3. Mount components, not mounted on front of panel, on removable back panel secured to enclosure with collar studs.

4. Install wiring in neat, workmanlike manner and group, bundle, support and route horizontally and vertically for neat appearance.

5. Terminate wires leaving panel at terminal strips inside enclosure.

6. Identify terminals and wires in accordance with panel wiring diagrams.

7. Furnish copper grounding plate inside control panel for terminating ground wires.

B. Transient Voltage Surge Suppressor: Furnish three phase transient voltage surge suppressor in pump control panels to protect panel components from potential damage from transient voltages caused by lightning or surges on incoming power line. Furnish indication light to indicate unit is functioning.

C. Three-Phase Monitor:

1. Furnish a three-phase power monitor in motor control panel to monitor incoming power and sense loss of any one of three phases.

    a. Inhibit pump operation when phase loss occurs.
    b. Surface mounted.

D. Motor Circuit Protector Type Circuit Breakers:

1. Furnish properly sized motor circuit protector type molded case circuit breaker for each pump motor starter.

    a. Type: Quick-make, quick-break, individually mounted.
    b. Minimum Interrupting Capacity: 22,000 amperes RMS symmetrical at 600 volts.

E. Motor Starters:

1. Furnish across-the-line magnetic type rated in accordance with NEMA standards, sizes and horsepower ratings. Size for motor horsepower.

2. Furnish each motor starter with a three-pole overload relay. Furnish heater element in each phase of relay, sized for motor nameplate full load amps.

3. Furnish overload reset button for each motor starter.

F. Control Transformer: Furnish 240-volt to 120-volt shielded isolation transformer in pump control panel to provide 120 VAC control power. Size transformer to power connected devices and protect with primary and secondary fusing.

G. Power Circuit Breakers:

1. Furnish quick-make, quick-break thermal-magnetic molded case type, individually mounted and identified.

2. Furnish individual power circuit breakers for each of the following:

    a. Each Motor Power and Control Circuit.
    b. NEMA 4X Duplex Receptacle located outside panel for service.
    c. Duplex Receptacle located inside panel for programming.
    d. 24-volt DC Power Supplies
    e. Panel lighting, cooling and heating if necessary.
    f. 2 spare power circuits

H. Selector Switches:

1. NEMA Type 4X, 30.5 mm, heavy-duty, non-illuminated, maintained contact type with double-break silver contacts.

I. Push Buttons: NEMA Type 4X, 30.5 mm, heavy-duty, non-illuminated, momentary contact type with double-break silver contacts.

J. Pilot Lights:

1. NEMA Type 4X, 30.5 mm, heavy-duty, transformer type.

   a. Voltage Rating: 120 volts AC or 24 volts DC as required.
   b. Color Caps: Green for "run", red for "ready" and amber for “alarm”.

2. Furnish "run" and “ready” pilot lights for each motor. Energize each “run” light through auxiliary contact on motor starter. Energize each “ready” light when the motor is not running, selector switch is in “Auto” or “Remote” position and no alarm conditions exist.

3. Furnish "motor high temperature" and "motor overload" alarm pilot light for each motor.

4. Furnish Reservoir "high level" and "low level" alarm pilot lights.

K. Legend Plates for Pilot Devices:

1. Furnish 2-1/4 inch (60 mm) square plastic legend plate for each selector switch, push button and pilot light.

2. Color: White with black lettering.

L. Relays:

1. Heavy-duty, general purpose type, with 10-amp contacts.

   a. Blade type terminals that plug-in to socket.
   b. DIN rail mounted to inside of panel enclosure.
   c. Contact Configuration: As required for proper operation of control logic.
   d. Operating Power: 120 volts AC or 24 volts DC as required.
   e. Furnish indicator light to indicate relay coil is energized.
   f. All relay coils shall have surge suppression devices installed.

M. Elapsed Time Meters:

1. Resettable, time totalizer type.

   a. Furnish synchronous motor to drive set of digit readout wheels to indicate total time pump motor starter is energized.

   b. Readout: Six-digit including 1/10 digit.

   c. Range: 0 to 99999.9 hours.

   d. Voltage Rating: 120 volts.

2. Furnish elapsed time meter for each pump. Energize each elapsed time meter through auxiliary contact on motor starter.

N. Terminal Blocks:

1. Furnish terminal blocks in control panel for field wiring.

   a. NEMA type, rated for 600 volts AC.

   b. Identify with permanent machine printed marking in accordance with terminal numbers shown on panel wiring diagrams.

   c. Furnish twenty five percent spare terminal blocks in control panel.

O. Wiring:

1. Furnish pump control panel completely wired by manufacturer.

2. Furnish wiring, workmanship, and schematic wiring diagrams in compliance with UL 508A. Isolate wiring and terminal blocks by voltage levels to greatest extent possible.

3. Wiring: Stranded copper, Type MTW or THW, 600 volts, color coded as follows:

   a. Line and Load Circuits, AC Power: Black.
   b. AC Control Circuit Less than Line Voltage: Red.
   c. DC Control Circuit: Blue.
   d. Interlock Control Circuits from External Source: Yellow.
   e. Equipment Grounding Conductor: Green.
   f. Current Carrying Grounded Conductor: White.

4. Minimum Size of Control Wiring: Number 16.

5. Tag control wiring at both ends in control panel with legible permanent coded wire marking sleeve. Mark with white PVC tubing sleeves with machine printed black marking. Mark in accordance with wire numbers shown on shop control wiring diagrams and terminal strip numbers.

P. Nameplates:

1. Furnish laminated phenolic nameplates on front of control panel.
2. Color: White with black engraved letters.
3. Minimum Size of Engraving: 1/4 inch (6 mm).

2.3 POWER SUPPLY AND CONDITIONING

A. Except for power supply units which form an integral part of an individual piece of equipment, all power supply and conditioning equipment shall comply with UL 1012 and shall be approved by UL, CSA, or FM for the application. All power supply equipment shall be provided in redundant configurations such that failure of a single unit will not disable all or any part of the instrumentation and communication systems. Diode isolation shall be provided for redundant direct current supply units, and the power supply negative output terminal shall be grounded.

B. Alternating Current (AC) Voltage Regulators:

1. Regulators shall be of the solid-state tap-changing type, insensitive to line frequency variations between 47 and 63 hertz. Ferro resonant units are not acceptable. Output regulation for input voltage variation from 85 to 125 volts shall not exceed 3.3 percent. Output regulation for load variation from 0 to 100 percent shall not exceed 1.0 percent. Response time shall be 1.0 cycles or less. Voltage regulators serving panelboards and control panels shall have a load capacity not less than 200 percent of the connected load. Voltage regulators serving individual instruments shall have a load capacity not less than 125 percent of the connected load. Power loss in the regulator shall not exceed 2 percent of the regulator capacity, and harmonic distortion introduced by the regulator shall not exceed 0.1 percent. Regulator output shall be fully protected against internal faults, external overloads and short circuits. Three-phase units shall be 4-wire, wye-connected and capable of supporting 100 percent unbalanced load. Regulators shall be Topaz 73000 series, or approved equal.

C. Noise-Suppression Isolation Transformers:

1. Isolation transformers shall be provided for AC powered instrumentation loads containing solid state circuitry where such is not included within the instrument. Isolation transformers shall be of the triple box shield type. Each coil shall be completely enclosed in a grounded conductive faraday shield, and the overall transformer enclosed in a faraday shield. Common mode noise attenuation between primary and secondary shall exceed 140 dB at 1.0 kHz. Isolation transformer dielectric strength shall be 2500 volts minimum. Isolation transformers serving panelboards and control panels shall have a load capacity not less than 200 percent of the connected load. Isolation transformers serving individual instruments shall have a load capacity not less than 125 percent of the connected load. Power loss in the isolation transformer shall not exceed 2.0 percent of the maximum load rating. Harmonic distortion introduced by the isolation transformer shall not exceed 0.1 percent. Three-phase units shall be 4-wire, wye-connected and capable of supporting 100 percent unbalanced load. Isolation transformers shall be Acme/Heavy Duty or approved equal.

D. Direct-Current Power Supplies:

1. Nominal 24-volt direct-current instrumentation and control power supply:

a. Convection-cooled linear type or switching type.

b. Line regulation: 0.4 percent for line variations from 105 to 132 volts

c. Load regulation: 0.4 percent for load variations from 0 to full load.

d. Ripple and noise: Not exceed 100 mV peak-to-peak.

e. Hold-up time at maximum load: Not less than 16 milliseconds.

f. Continuous duty from 0 to 50 degrees C at rated load.

g. Output electronically current limited.

h. Over-voltage crowbar shutdown.

i. Full voltage / amperage redundancy.

j. Output voltage:

1) Rated 28 Vdc
2) Adjustable plus or minus 5 percent
3) Set to provide 26.4 volts to the panel direct current bus.

k. Power Supply: Phoenix Contact, or approved equal.

l. Provide dry contact for failure alarm. Dry contact to be wired to PLC input.

E. Electromagnetic Interference Filter (EMI):

1. DIN rail mountable.
2. Power rating: 20 amps at 120Vac, single phase.
3. Provide individual units for each DC power supply.
4. Type 3 surge protection, with high frequency suppression filter.
5. EMI shall be manufactured by Phoenix Contact, SFP 1-20/120AC or equal.

2.4 SURGE PROTECTION

A. Provide primary surge protectors, per NEC Article 800.90 on all signal conductors entering the panel. Surge protectors shall be multi-stage, plug-in type selected to protect the equipment, and listed per ANSI/UL497. Surge protectors shall be

removable without changing the impedance of the circuit. Surge protector product manufactures shall be:

1. Circuit Components Inc: Din Rail SDD-400 Series for Data or Analog Signals.
2. Phoenix Contact
3. Edco
4. Approved equal

B. Provide Type 1 surge protective devices, per NEC Article 285, at the power feed to the panel. Surge Protective Devices (SPD) shall be designed to provide transient voltage protection for a service entrance panelboard. SPD units shall comply with UL 1449 3rd Edition, and shall be listed for such use. SPD units shall be rated for the voltage and phase service of the panel at 120 kA per phase. SPD units shall have a built-in diagnostic package with flashing trouble indicator, a display for the status of each phase, and a counter and display to indicate the number of surges that have caused the device to operate.

C. SPD units shall be Eaton Clipper Power System, Visor Series, Circuit Components Inc, SPD-Series, or approved equal.

D. Surge arrestors and capacitors shall be provided on the primary winding of isolation transformers supplying power to solid state systems. Surge protectors shall be mounted in a separate, NEMA 1 enclosure adjacent to the transformer and the incoming line passed through this enclosure. Surge arrestors shall be General Electric 9L15EC or equal. Surge capacitors shall be General Electric 9L18B, or approved equal.

2.5 PANEL GROUNDING

A. Each panel shall be provided with two copper ground bars.

1. One bar (NEC required) shall be bonded to the panel or panel frame or back-plate and to the facility grounding system.

2. Second (signal) ground bar shall be mounted on insulated stand-offs and shall be bonded to the panel ground bar only at one point.

B. Signal circuits, signal cable shields, and low-voltage DC power supply commons shall be bonded to the signal ground bar.

C. Field analog wiring shields shall only be grounded at the signal ground bar. Test to verify that single ground point at panel signal ground bar.

D. Surge protectors and separately derived AC power supplies shall be bonded to the frame ground bar.

E. Panels exceeding 36-inches width shall contain ground bars shall be 1/4- by 1-inch copper bars extending the entire length of the panel interior at the bottom of the panel.

2.6 HUMAN MACHINE INTERFACE (HMI)

A. Panel mounted color touch sensitive graphics screen.

1. Power: 120vac (UPS sourced)

2. Color screen:

a. TFT touch active flat panel screen
b. Minimum resolution: 1024 X 768, 18-bit graphics.
c. 15-inch diagonal minimum.

3. UL Listed.

4. Communications:

a. TCP/IP Ethernet connection.
b. USB – 2 ports minimum

B. Manufacturers:

1. Automation Direct EA9-T15CL
2. Approved equal

2.7 NETWORK ETHERNET SWITCH

A. DIN Rail Mounted Ethernet switch(s) shall be provided with the following features:

1. Unit shall provide for Ethernet copper providing managed switch capability.

2. A minimum of 8 RJ-45 10/100/1000 auto negotiating ports.

3. Power Supply: 24Vdc Redundant

4. A minimum of 1 one-Gigabyte SFP port.

5. Ethernet switch shall be fully managed Layer 2 capability, with software.

6. All required cabling for internal connections shall be supplied by the panel supplier. Network cable shall be a minimum of CAT-6.

7. Manufacturers: Red Lion NTron 708TX or approved equal.

2.8 SOURCE QUALITY CONTROL AND TESTS

A. Perform a factory test of completed control panel by demonstrating operation of control functions. Provide certified test results.

B. Factory assemble and test each control and alarm function.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify correct power supply is available.
B. Verify all field equipment is installed and adjusted.

3.2 INSTALLATION

A. Install control panel at location indicated on Drawings.
B. Install control panel in accordance with manufacturer’s instructions.

3.3 FIELD QUALITY CONTROL

A. Section 01 75 16 - Testing, Training & System Startup: Field inspecting, testing, adjusting, and balancing.

B. Start-up pump control system by energizing system equipment and testing operation of hardware and process control logic under supervision of manufacturer's representative and in presence of the Owner’s representative.

C. Equipment Acceptance:

1. Adjust, repair, modify or replace system components that fail to perform as specified and rerun tests. Make final adjustments to equipment under direction of manufacturer's representative.

2. Document adjustments, repairs and replacements in manufacturer’s field services certification.

3.4 MANUFACTURER'S FIELD SERVICES

A. Furnish services of manufacturer's representative experienced in installation of products furnished under this specification on-site for installation inspection and field testing, and instructing Owner's personnel in maintenance of equipment.

B. Certify that equipment has been properly installed and is ready for start-up and testing.

3.5 DEMONSTRATION

A. Section 01 75 16 - Testing, Training & System Startup: Requirements for demonstration and training.

B. Demonstrate equipment startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner's personnel.

END OF SECTION

SECTION 43 21 00

LIQUID PUMPS

PART 1 GENERAL

1.1 SUMMARY

A. The provisions of this Section shall apply to all pumps and pumping equipment except where otherwise indicated.

B. Where two or more pump systems of the same type or size are required, all pumps shall all be produced by the same manufacturer.

C. Provide all labor, equipment and materials and perform all operations in connection with the installation and testing of pumps selected by the OWNER.

D. Coordinate and utilize all factory testing, installation, start-up and field testing services supplied in conjunction with the pumping equipment.

E. All work performed under this Section shall be in accordance with all approved trade practices and manufacturer's recommendations.

F. Section includes:

1. General design requirements for liquid pumps.
2. Factory testing.

G. Related Requirements:

1. Section 33 12 23 - Water Utility Pumping Stations.

1.2 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Provide the following information:

1. Pump name, identification number and applicable Section number from Project specifications.

2. Performance Data Curves:

a. Showing head, capacity, horsepower demand, NPSH required and pump efficiency over the entire operating range of the pump.

b. Pump manufacturer shall indicate separately the head, capacity, horsepower demand, overall efficiency and minimum submergence required at the design flow conditions and the maximum and minimum flow conditions.

c. A family of performance curves at intervals of 100 rpm from minimum speed to maximum speed shall be provided for each centrifugal pump equipped with a variable speed drive, and a curve for each speed on two-speed pumps.

3. The limits on the performance curves recommended for stable operation without surge, cavitation or excessive vibration.

4. Assembly and Installation Drawings: Including shaft size, seal, coupling, bearings, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights.

C. Complete motor nameplate data as defined by NEMA, motor manufacturer and any motor modifications.

D. Operation and Maintenance Manual: Containing the required information for each pump section.

E. Spare Parts List: Containing the required information for each pump section.

F. Factory Test Data: Signed, dated and certified for each pump system which requires factory testing submitted before shipment of equipment.

G. Certifications:

1. Manufacturer’s certification of proper installation.
2. CONTRACTOR’s certification of satisfactory field testing.

H. All pump motor information as required in Division 43.

I. Provide lateral and torsional analysis as specified under Submittals Article of Section 11 05 00, Common Work Results for Equipment.

PART 2 PRODUCTS

2.1 GENERAL

A. Materials and equipment shall be standard products of a manufacturer and distributor regularly engaged in the manufacture and distribution of such products for at least 2 (two) years and shall be suitable for the service intended.

B. All materials and equipment shall be new and unused except for the testing specified herein.

C. Compliance with the requirements of the individual pump sections may necessitate modifications to the manufacturer's standard equipment.

D. All centrifugal pumps shall have a continuously rising performance curve. In no case shall the required horsepower at any point on the performance curve exceed the rated horsepower of the motor or engine or encroach on the service factor.

E. All components of each pump system provided under the pump sections shall be entirely compatible. Each unit of pumping equipment shall incorporate all basic mechanisms, couplings, electric motors or engine drives, variable speed controls, necessary mountings and appurtenances.

F. The pumps shall be supplied by a distributor authorized to service them throughout the warranty period and beyond. The distributor shall be located within a 100-mile radius of the site.

G. The pumps shall be warranted by the manufacturer for a minimum of one (1) year from the date of installation.

H. All materials and coatings coming in contact with potable water shall be ANSI/NSF Standard 61 approved.

I. The pumping units shall all be supplied by one manufacturer and shall be complete including pumps, motors, suction cans, baseplates, couplings, guards and other accessories.

J. The complete pump assembly shall be designed and built for continuous service at any and all points within the specified range of operation, without overheating, without damaging cavitation, and without excessive vibration or noise.

2.2 MATERIALS

A. All materials shall be suitable for the intended application; materials not specified shall be high-grade, standard commercial quality, free from all defects and imperfection that might affect the serviceability of the product for the purpose for which it is intended, and shall conform to the following requirements:

1. Cast iron pump casings and bowls shall be of close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Casings, Class 30, or equal.

2. Stainless steel pump shafts shall be Type 416 or 316.

3. Miscellaneous stainless steel shall be of Type 316, except in a septic environment.

4. Anchor bolts, washers, and nuts supplied by the CONTRACTOR for non-corrosive applications shall be galvanized steel in accordance with the requirements of

Section 05 50 00, Metal Fabrications. Anchor bolts, washers and nuts in corrosive service applications shall be stainless steel in accordance with that Section.

2.3 PUMP COMPONENTS, GENERAL

A. Flanges: Suction and discharge flanges shall conform to ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 12, 125, 250, and 800 or B16.5 - Flanges and Flanged Fittings dimensions.

B. Handholes: Handholes on pump casings shall be shaped to follow the contours of the casing to avoid any obstructions in the water passage.

2.4 PUMP APPURTENANCES

A. Nameplates: Each pump shall be equipped with a stainless steel nameplate indicating serial numbers, rated head and flow, impeller size, pump speed and manufacturer's name and model number.

B. Gauges: Provide and install pressure gauges as shown on the Drawings.

1. All pumps (except sample pumps, sump pumps, hot water circulating pumps and chemical metering pumps) shall be equipped with pressure gauges on the pump discharge.

2. Pump suction lines shall be provided with compound gauges.

3. Gauges shall be located in a representative location, where not subject to shock or vibrations, in order to achieve true and accurate readings.

4. Isolation diaphragms shall be provided for all gauges except where pumping potable water.

5. Where subject to shock or vibrations, the gauges shall be wall-mounted or attached to galvanized channel floor stands and connected by means of flexible connectors.

2.5 FACTORY TESTING

A. The following tests shall be conducted on each indicated pump system:

1. Pump Systems: All centrifugal pump systems 50 hp and larger shall be tested at the pump factory in accordance with the American National Standard for Centrifugal Pump Tests (ANSI/HI 1.6) or the American National Standard for Vertical Pump Tests (ANSI/HI 2.6) as approved by ANSI and published by the Hydraulic Institute.

2. Tests shall be performed using the complete pump system to be furnished, including the motor.

3. For motors 100 hp and smaller, the manufacturer's certified test motor shall be acceptable. The following minimum test data shall be submitted:

    a. Hydrostatic test data.

    b. A minimum of five hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, recorded on data sheets as defined by the Hydraulic Institute.

    c. Pump curves showing head, flow, bhp, efficiency and NPSH requirements.

    d. Certification that the pump horsepower demand did not exceed the rated motor hp beyond the 1.0 service rating at any point on the curve.

    e. Pump test data curves showing head, flowrate, bhp, and efficiency. Acceptance level shall be Grade 1E as defined by ANSI/HI 14.6.

4. Factory Witnessed Tests: Factory witnessed testing for this project not required.

5. Acceptance: In the event of failure of any pump to meet any of the requirements, the CONTRACTOR and Pump Manufacturer shall make all necessary modifications, repairs or replacements to conform to the requirements of the Contract Documents and the pump shall be retested at no additional cost to the OWNER until found satisfactory.

B. The pump manufacturer shall complete a lateral and torsional analysis where required and as specified in the Submittal Article of Section 11 05 00, Common Work Results for Equipment. This analysis shall identify the dry and wet lateral critical and the torsional critical speeds of the pump system, and shall be submitted for review as part of the pump submittal.

PART 3 EXECUTION

3.1 SERVICES OF PUMP MANUFACTURER

A. An authorized service representative of the manufacturer shall visit the Site to witness the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted and readied for operation:

1. Installation of the equipment.

2. Inspection, checking and adjusting the equipment.

3. Startup and field testing for proper operation.

4. Performing field adjustments to ensure that the equipment installation and operation comply with requirements.

5. Requirements are more specifically detailed herein and in individual pump specifications.

B. Instruction of the OWNER's Personnel:

1. An authorized training representative of the manufacturer shall visit the Site to instruct the OWNER's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment.

2. Instruction shall be specific to the models of equipment provided.

3. The pump manufacturer's representative shall have at least two years' experience in training.

4. Training shall be scheduled a minimum of three weeks in advance of the first session.

5. Proposed training material and a detailed outline of each lesson shall be submitted for review. Comments shall be incorporated into the material.

6. The training materials shall remain with the trainees.

7. The OWNER may videotape the training for later use with the OWNER's personnel.

3.2 INSTALLATION

A. General: Pumping equipment shall be installed in accordance with the manufacturer's written recommendations.

B. Alignment:

1. All equipment shall be field tested to verify proper alignment, operation as specified and freedom from binding, scraping, vibration, shaft runout or other defects.

2. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing.

3. Equipment shall be secure in position and neat in appearance.

C. Lubricants: Provide the necessary oil and grease for initial operation.

3.3 FIELD TESTS

A. Each pump system shall be field tested after installation to demonstrate satisfactory operation without excessive noise, vibration, cavitation or overheating of bearings.

B. Field testing methods and allowable tolerances shall comply with current version of the Hydraulics Institute standards for the type of pumps installed.

C. The following field testing shall be conducted:

1. Startup, check and operate the pump system over its entire speed range. Where vibration analysis and measurement is required, it shall be within the amplitude limits specified and recommended by the Hydraulic Institute Standards at a minimum of four pumping conditions defined by the ENGINEER.

2. Obtain concurrent readings of motor voltage, amperage, pump suction head and pump discharge head for at least four pumping conditions at each pump rotational speed. Check each power lead to the motor for proper current balance.

3. Determine bearing temperatures by contact type thermometer. A run time of at least 20 minutes shall precede this test, unless insufficient liquid volume is available.

4. Electrical and instrumentation tests shall conform to the requirements of the Section under which that equipment is specified.

5. Field vibration readings shall be conducted by an Owner-selected certified testing agency, paid for by the CONTRACTOR, with readings taken at the following positions with the average not exceeding the current Hydraulic Institutes standards for the type of pump installed.

    a. Measurements shall be taken at the locations as specified in the current Hydraulic Institute standards for the type of pump installed.

6. Provide written proof of vibration readings and provide test data.

D. Field testing will be witnessed by the ENGINEER. The CONTRACTOR shall furnish three days advanced notice of field testing.

E. In the event any pumping system fails to meet the test requirements, it shall be modified and retested as above until it satisfies the requirements.

F. After each pumping system has satisfied the requirements, the CONTRACTOR shall certify in writing that it has been satisfactorily tested and that all final adjustments have been made. Certification shall include the date of the field tests, a listing of all persons present during the tests and the test data.

G. CONTRACTOR shall bear all costs of field tests, including additional services of the manufacturer's representative required beyond those specified.

END OF SECTION

SUPPLEMENTARY INFORMATION

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October 27, 2017

W1204 GEOTECHNICAL RPT

Murraysmith
400 E. Mill Plain Boulevard, Suite 203
Vancouver, WA 98660

Attention: Kyle Thompson

SUBJECT: Geotechnical Investigation
Vader-Enchanted Valley Reservoir
Lewis County, Washington

At your request, GRI has completed a geotechnical investigation of the proposed Vader-Enchanted Valley Reservoir northeast of Vader in Lewis County, Washington. The general location of the site is shown on the Vicinity Map, Figure 1. Our investigation included review of available geotechnical and geologic data for the site, subsurface explorations, laboratory testing, and engineering studies and analyses. This report describes the work accomplished and provides our conclusions and recommendations for design and construction of the proposed reservoir.

PROJECT DESCRIPTION

We understand that Lewis County (County) plans to construct a new 250,000-gal reservoir, perimeter access roads, booster pump, and yard piping at their existing facility located at 1333 South Military Road in Lewis County, Washington. The site configuration is shown on the Site Plan, Figure 2. We understand that the new reservoir will be located to the northeast of the existing reservoir, will have a diameter of 55 ft, and the maximum water height will be 14 ft. The finished floor elevation for the new tank will match the finished floor elevation for the existing tank (i.e., about elevation 316 ft), necessitating about a 10-ft-deep cut on the uphill side of the proposed tank. As currently envisioned, the cut slope will be inclined at about 2.5H:1V (Horizontal:Vertical) and have a total height of about 20 ft, which is similar to the cut slope for the existing reservoir. Fill up to about 2 ft above existing grades is planned for construction of the access road around the south side of the reservoir.

We understand that the reservoir will be welded steel and be supported by a perimeter ring footing and a single internal column footing. For static loading conditions, the footing loads from the weight of the structure and hydrostatic water loads will be about 2,100 lb/ft and 8,600 lbs for perimeter ring and column footings, respectively. For seismic loading conditions, the footing loads are estimated to be about 2,700 lb/ft and 8,600 lbs for the perimeter ring and column footing, respectively.

A clamshell-style pump will be constructed to the southwest of the existing tank. The pump will be founded on an approximately 10 ft by 10 ft concrete slab on grade. New yard piping will be constructed to tie the new pump and reservoir into the existing system. We understand that the invert of the yard piping will be within 3 to 4 ft of the existing ground surface.

Unless specified elsewhere, all elevations in this report refer to the North American Vertical Datum of 1988 (NAVD 88).

SITE DESCRIPTION

Topography and Surface Conditions

The water reservoir site is located at the northeast corner of the intersection of Military Road and SR 506. The reservoir site is on a southeastern facing slope about half way between SR 506 and the relatively flat top of the hill. The ground surface elevation ranges from about elevation 285 ft at SR 506 to about elevation 350 ft at the top of the slope. The overall inclination of the natural ground surface is about 6H:1V.

Existing improvements at the site include a 55-ft-diameter steel water reservoir, a water treatment facility building, and discharge lagoons. The existing reservoir is founded on an excavated bench between about elevation 315 and 316 ft. The cut slope for the bench is inclined at about 2.5H:1V and is covered with grass and small tree stumps. No obvious visible indications of groundwater seepage onto this cut slope were observed during our geotechnical investigation. The proposed reservoir will be located to the east of the existing improvements. The undeveloped area to the north, south, and east of the existing reservoir and within the footprint of the proposed reservoir is covered with mature evergreen trees and light underbrush.

During our geotechnical investigation, GRI did not observe any obvious visible indications of deep-seated slope movement on the subject property, such as bowed trees, scarps, or hummocky ground surface.

Geology

Near-surface soils at the site are mapped as alpine glacial deposits of the Logan Hill Formation (Phillips, 1987). These deposits reportedly are gravel, sand, and till consisting of a compact mixture of gravels, cobbles, and boulders in a sandy clay matrix. Portions of the unit are mantled with 5 to 15 ft of silt and clay. The Logan Hill Formation is reportedly underlain by bedrock of the Cowlitz Formation, which consists of massive to thin-bedded sandstone with interbedded siltstone, shale, and lignite.

A large historical landslide is mapped north and east of the site (Phillips, 1987). The landslide scarp is located just east of Military Road north of the site and the landslide debris extends all the way to the Cowlitz River at the southeast edge of the landslide. The closest portion of the mapped landslide is located about 800 ft to the northeast.

SUBSURFACE CONDITIONS

General

Subsurface materials and conditions at the site were investigated between September 26 and September 28, 2016, with three borings, designated B-1 through B-3. The approximate locations of the borings advanced for this study are shown on Figure 2. The borings were advanced to depths between 41 and 86.5 ft using mud-rotary drilling techniques. Logs of the borings are provided on Figures 1A through 3A. A detailed discussion of the field exploration and laboratory testing programs are provided in Appendix A. The terms and symbols used to describe the soils encountered in the borings are defined in Table 1A and the attached legend.

Soils

For purpose of discussion, the materials disclosed by the borings have been grouped into the following major units based on their physical characteristics and engineering properties. Listed as they were encountered from the ground surface downward, the units are:

1. **Clayey SILT (Logan Hill Formation)**
2. **Sandy SILT to Silty SAND (Logan Hill Formation)**
3. **Silty CLAY (Decomposed Cowlitz Formation)**

1. Clayey SILT (Alpine Glacial Drift). Clayey silt was encountered in all the explorations from the ground surface to a depth of about 25 ft. The clayey silt contains varying amounts of fine- to coarse-grained sand, ranging from a trace of sand to some sand. Below 7.5 to 10 ft, the clayey silt contains variable gravel content, ranging from a trace of gravel to gravelly. Based on SPT N-values of 5 to 16 blows/ft, a Torvane shear strength value of 0.4 tsf, and unconfined compressive strength values of 0.15 to 0.45 tsf, the relative consistency of the silt ranges from soft to very stiff, and is typically medium stiff to stiff. The natural moisture content of the silt ranges from 25 to 59%. One Atterberg limits test was performed on a representative sample of the silt from boring B-1 and the results are presented on the Plasticity Chart, Figure 4A. Based on this testing, the silt has a liquid limit (LL) of about 48% and a plasticity index of about 17%, indicating the silt has medium plasticity.

Three one-dimensional consolidation tests were completed on representative samples of the clayey silt. One test was completed on the near-surface clayey silt (boring B-3, sample S-2) with no obvious visible gravel content. The remaining tests were completed on samples of the deeper clayey silt that contains variable gravel content (boring B-2/S-5 and boring B-3/S-5) ranging from a trace of gravel to gravelly. The testing indicates that the upper 7.5 to 10 ft of clayey silt is normally consolidated to slightly overconsolidated while the deeper clayey silt is moderately overconsolidated. The clayey silt typically displays very slight compressibility in the preconsolidated range of stresses and moderate compressibility in the normally consolidated range. The results are presented on consolidation charts provided on Figures 5A through 7A.

2. Sandy SILT to Silty SAND (Alpine Glacial Drift). Sandy silt was encountered between 25 and 35 ft in boring B-3. The sandy silt contains trace clay and variable gravel content, ranging from trace gravel to gravelly. Based on SPT N-values of 7 and 12 blows/ft, the relative consistency of the sandy silt is medium stiff to stiff. Based on the results of a single moisture content test, the sandy silt has a natural moisture content of 52%.

Silty sand was encountered at a depth of 25 ft in borings B-1 and B-2 and at a depth of 35 ft in boring B-3. The silty sand is fine to medium grained and contains trace clay and trace to some gravel. Based on SPT N-values of 7 to 21 blows/ft, the silty sand is loose to medium dense, and is typically medium dense. The natural moisture content of the silty sand is between 30 and 48%. Boring B-1 was terminated in the silty sand at a depth of about 41.5 ft.

3. Silty CLAY (Decomposed Cowlitz Formation). Silty clay was encountered below a depth of 50 ft in boring B-2 and below a depth of 55 ft in boring B-3. The silty clay contains trace fine-grained sand. Based on SPT N-values between 14 blows/ft to 50 blows for 6 in. of sampler penetration, defined as practical refusal, the relative consistency of the silty clay is stiff to hard. The upper 5 ft of silty clay is stiff to very stiff, based

on SPT N-values of 14 and 19 blows/ft. The relative consistency of the underlying silty clay is very stiff to hard, based on SPT N-values ranging from 16 blows/ft to 50 blows for 6 in. of sampler penetration, defined as practical refusal. The natural moisture content of the silt clay ranges from 27 to 52%. One Atterberg limits test was performed on a representative sample of the silty clay from boring B-2. This testing indicates that the silty clay has a liquid limit (LL) of about 65% and a plasticity index of about 36% indicating the clay has high plasticity. Borings B-2 and B-3 were terminated in the silty clay unit at depths of 71.5 and 86.5 ft.

Groundwater

A vibrating-wire piezometer was installed in boring B-3 and the groundwater data is summarized on Figure 3. The vibrating-wire piezometer was set at a depth of about 20 ft below the ground surface (elevation 313 ft) and is connected to a data logger system that automatically recorded the groundwater level at 12-hr intervals between September 28, 2016 and September 11, 2017. During this time period, the groundwater level in boring B-3 fluctuated between about elevation 313 ft and 322 ft (i.e., 11 ft to greater than 20 ft below the ground surface) with the shallowest groundwater measured on February 9, 2017 after a period of heavy rainfall. Rainfall data recorded at a nearby weather station during the same time period is also shown on Figure 3. Installation details for the piezometers are described in Appendix A and shown graphically on Figure 3A.

CONCLUSIONS AND RECOMMENDATIONS

General

The explorations disclosed about 25 ft of medium stiff to stiff clayey silt underlain by medium stiff to stiff sandy silt and loose to medium dense silty sand (Logan Hill Formation). These deposits are underlain by very stiff to hard silty clay formed by decomposition of the underlying mudstones of the Cowlitz Formation. A piezometer was installed in boring B-3 and the groundwater was measured at a depth of about 18 ft below the ground surface on October 13, 2016.

The primary geotechnical considerations associated with the project include seismic considerations, moisture sensitive silt and clay soils, slope stability, foundation support, and tank settlement. Our conclusions and recommendations are discussed below.

Seismic Considerations

General. We understand the project will be designed using both the American Water Works Association document AWWA D100-11, *Welded Carbon Steel Tanks for Water Storage*, and the 2015 *International Building Code* (IBC). Both the AWWA Standard D100-11 and the 2015 IBC are based on the American Society of Civil Engineers (ASCE) 7-10 document, titled *Minimum Design Loads for Buildings and Other Structures* (ASCE 7-10).

The IBC design methodology uses two spectral response parameters, S_S and S_1, corresponding to periods of 0.2 and 1.0 second, to develop the Risk-Targeted Maximum Considered Earthquake (MCE_R) response spectrum. The spectral response parameters were obtained from the U.S. Geological Survey (USGS) Hazard Response Spectra Curves for the coordinates of 46.4044° N latitude and 122.9461° W longitude. Based on soil characteristics, the soil column at the site would be classified as IBC Site Class D. The S_S and S_1 parameters identified for the site are 1.03 and 0.46 g, respectively. These spectral response parameters are adjusted for Site Class with the 0.2 and 1.0 second period site coefficients, F_a and F_v, based on the soil profile

in the upper 100 ft. This spectrum is designated the MCE_R-level spectrum. The design-level response spectrum is calculated as two-thirds of the Site Class-adjusted MCE_R-level spectrum.

We recommend using the code-based 0.2- and 1-second period site coefficients, F_a and F_v, for Site Class D to estimate the ground surface MCE_R spectrum. The F_a and F_v factors are 1.09 and 1.54, respectively. The spectral values are generally based on a damping ratio of 5%. The code-based MCE_R and design response spectra values are tabulated below.

2015 IBC SEISMIC DESIGN RECOMMENDATIONS

Seismic Variable	Recommended Value
Site Class	D
MCE_R 0.2-Second Period Spectral Response Acceleration, S_{MS}	1.12 g
MCE_R 1-Second Period Spectral Response Acceleration, S_{M1}	0.71 g
Design-Level 0.2-Second Period Spectral Response Acceleration, S_{DS}	0.75 g
Design-Level 1-Second Period Spectral Response Acceleration, S_{D1}	0.48 g

Other Seismic Considerations. In our opinion, the potential for earthquake-induced fault rupture at the ground surface is low unless occurring on a previously unknown or unmapped fault. Based on the location of the site and the grain size and stiffness of the soil beneath the site, it is our opinion the risk for liquefaction and liquefaction-induced lateral spreading, settlement, and subsidence is low. The risk of tsunamis or seiches at the site is absent.

Earthwork

Site Preparation. Surface vegetation and other organic materials within the limits of the proposed tank, fills, access roads, and other structures, should be stripped. Based on the conditions observed during our field investigation program, we anticipate a stripping depth of around 12 to 18 in. will be required to remove vegetation and loose forest topsoil. Deeper stripping and grubbing depths should be anticipated to remove the stumps and roots larger than about 1/2 in. associated with the larger trees present on the site. The strippings will not be suitable for structural fill and should only be used in landscape areas or removed from the site. Stripped areas to receive structural fill should be evaluated by a qualified geotechnical engineer. Soft areas, if encountered, should be overexcavated and backfilled with structural fill prior to placing new fill.

The silt and clay soils that mantle the site are moisture sensitive and are easily disturbed and softened by construction activity during wet conditions; therefore, site preparation and earthwork can be most efficiently accomplished during the typically dry, late spring to early fall months. If wet ground conditions exist, we recommend making all excavations using large hydraulic excavators equipped with smooth cutting edges, in lieu of bulldozers, to prevent softening of the subgrade soils. Also, the contractor should plan the earthwork operations such that no construction equipment, i.e., bulldozers, dump trucks, etc., traffic the exposed silt and clay soils. This will require the placement of imported granular fill for working pads and/or

haul roads as the excavation progresses. If the subgrade is disturbed during construction, soft, disturbed soils should be overexcavated to firm soil and backfilled with clean, granular materials.

In our experience, granular haul roads and work pads to support construction traffic generally require a minimum of 18 to 24 in. of relatively clean, fragmental rock having a nominal maximum size of 4 to 6 in. If the subgrade is particularly soft, it may be advisable to place a woven separation fabric, such as Mirafi 500X (or equivalent), on the exposed subgrade prior to placement and compaction of the granular work pad.

On-Site Structural Fill Materials. Excluding the surface strippings, the on-site overburden silt and clay soils approved by the geotechnical engineer can be used to construct structural fills that are outside the reservoir footprint. The silt and clay soils are sensitive to moisture content and can only be placed and adequately compacted during dry weather when the moisture content can be controlled. In particular, the on-site soils are well above their optimum moisture content and will likely require some drying to compact in structural fills. A segmented-pad compactor is most appropriate for compaction of the silt and clay soils present on the site. Silt and clay soils used to construct structural fills should be placed in maximum 6- to 8-in.-thick (loose) lifts and compacted to at least 95% of the maximum dry density as determined by ASTM D698 (standard Proctor) at a moisture content within 3% of optimum. The nominal maximum size of on-site gravel or cobbles used for fill should be limited to about 4 in. Landscape fill should be compacted to about at least 90% of the maximum dry density as determined by ASTM D698. The moisture content of soils placed in landscaped areas is generally not critical, provided construction equipment can effectively handle the material.

Wet-Weather Fill Material. Imported granular material consisting of hard, durable fragmental rock up to 4 in. maximum size and less than 7% passing the No. 200 sieve (washed analysis) should be used to construct structural fills during wet conditions. The first lift of import fill material placed over the silt subgrade should range from 12 to 18 in. thick (loose) and should be compacted with a medium-weight (48-in.-diameter drum), smooth-drum, vibratory roller until well-keyed. Subsequent lifts of granular fill should not exceed a loose thickness of 12 in. and should be compacted to a density not less than 95% of the maximum dry density as determined by ASTM D698.

Utility Trench Excavation and Backfill. All backfill placed in utility trench excavations within the limits of improvements, such as the reservoir, roadway, or retaining walls, should consist of sand, gravel, or crushed rock with a maximum size of up to 1½ in. conforming to the requirements of Section 9-03.12(3) of the Washington State Department of Transportation (WSDOT) Standard Specifications. Granular backfill should be placed in lifts and compacted with vibratory equipment. Appropriate lift thickness will depend on the type of compaction equipment used. For example, if hand-operated vibratory plate equipment is used, lifts should be limited to 6 to 8 in. thick. If trackhoe-mounted vibratory plates are used, thicker lifts may be appropriate to achieve the required compaction. In areas of improvements, we recommend the upper 5 ft of the trench backfill be compacted to at least 95% of the maximum dry density as determined by ASTM D698. Trench backfill below a depth of 5 ft should be compacted to at least 92% of the recommended standard. Flooding or jetting the backfilled trenches with water to achieve compaction should not be permitted.

If seeps or groundwater are encountered within utility excavations, it may become necessary to overexcavate the trench bottom to permit installation of a granular working blanket to prevent bottom instability and

facilitate pumping from sumps. We estimate the required thickness of the granular working blanket will be on the order of 1 ft, or as required to maintain a stable trench bottom, depending on the conditions exposed in the trench and the effectiveness of the contractor's dewatering efforts. The thickness of the granular blanket must be evaluated by a qualified geotechnical engineer on the basis of field observations during construction. We recommend the use of relatively clean, free-draining material, such as 2- to 4-in.open-graded crushed rock with less than 5% passing the No. 200 sieve (washed analysis), for this purpose.

Permanent Slopes. Cuts slopes with a maximum height of up to about 20 ft will be made to grade the tank site and perimeter access road. Based on the conditions observed in our explorations, subsurface materials encountered within the cut will primarily consist of clayey silt with varying percentages of sand and gravel. Based on the geologic conditions at the site, we anticipate that cobble- and boulder-sized materials may also be encountered during the excavations. We anticipate this material can be excavated with a large tracked excavator equipped with smooth cutting edges.

Groundwater data was measured in boring B-3 between September 28, 2016, and September 11, 2017. During this time period, groundwater was measured in excess of 11 ft below the existing ground surface or below the base of the planned cut. GRI did not observe any groundwater seeps or erosion control measures (i.e., rip-rap) on the existing 2.5H:1V cut slope located north of the existing reservoir. In addition, John Strom, Vader Water System Operator for Lewis County, indicated that he could not recall water seeping out of the cut slope north of the reservoir. Based on these observations, the groundwater level is generally deeper than the planned cut and it is unlikely that significant quantities of groundwater will be encountered during the excavation for the cut, especially if construction occurs during the dry summer months of the year.

Based on the results of our stability analysis, final graded cut slopes should be inclined no steeper than 2.5H:1V. Due to the weathered nature of the materials composing the cut slope, it should be anticipated that gradual raveling of the slope may occur over time. More extensive slope movement or raveling, on the order of about 1 ft, is estimated as a result of the 2015 IBC code-based earthquake. We anticipate maintenance will be needed to remove accumulated debris from the base of the cut after the code-based earthquake and that periodic maintenance will be required to collect sloughed material.

Channelized or concentrated surface water runoff flowing toward the top of the excavation slopes should be intercepted by a ditch and directed away from the excavation.

Small structural fill slopes will be needed on the south side of the proposed reservoir. In our opinion, material used to construct fill slopes should meet the requirements for "Wet Weather Fill Material" discussed in this report. Structural fill should be placed and compacted a minimum of 2 ft beyond the final slope configuration and then trimmed back to final grade. The maximum inclination of structural fill slopes should be no steeper than 2H:1V.

To reduce erosion and raveling, permanent cut or fill slopes should be hydroseeded as soon as practical or covered with mulch or erosion-control netting/blankets.

Reservoir Foundation Support and Settlement

Foundation support for the reservoir can be provided by a conventional concrete perimeter ring footing and a single internal column footing established in the cut area, assuming the structure can tolerate some

settlement as described in the settlement section below. Footings should be established at a minimum depth of 18 in. below the lowest adjacent finished grade, and the width of the footings should not be less than 24 in. To provide uniform foundation support, we recommend the subgrade for the tank floor and footings and extending 5 ft beyond the tank footprint be overexcavated a minimum depth of 24 in. below the footing or tank floor elevation and backfilled with well graded angular crushed rock structural fill with a maximum size of 4 in. and less than 5% passing the No. 200 sieve (washed analysis). The crushed rock should be compacted to at least 95% of the maximum dry density as determined by ASTM D698. Prior to placing the crushed rock structural fill, the subgrade should be evaluated by a qualified geotechnical engineer or engineering geologist. Any soft areas should be overexcavated to firm soil and backfilled with crushed rock as described above.

For reservoir subgrade prepared as discussed above, spread footings for the tank can be designed to impose an ultimate bearing pressure of 4,500 psf for static loading combinations or load combinations including wind loads. For seismic loading combinations, an ultimate bearing pressure of 3,500 psf is appropriate for design of the spread footings. We understand that AWWA D100-11 requires that a factor of safety of at least 3.0 be applied to the estimated ultimate bearing pressures for static load combinations. For load combinations including seismic or wind loads, a minimum factor of safety of 2.25 is required by AWWA D100-11. Footing settlement induced by the full-tank water load will approach the estimated tank settlements discussed below.

The total settlement in the middle of the tank is estimated to be in the range of 3 to 4 in. Settlement at the edge of the tank is estimated to be 1/2 to 2/3 of the settlement in the middle of the tank. Some differential settlement around the perimeter should be anticipated due to variations in the soil properties and the depth of cut. We anticipate that differential settlement around the perimeter of the tank will be less than half of the total perimeter settlement. In our opinion, the differential settlement will be gradual and can be estimated to be a linear change across the width of the tank, i.e. no abrupt differential is anticipated over short distances. The majority of the tank floor and footing settlement will occur following filling of the tank.

Lateral loads (seismic, soil, etc.) can be resisted partially or completely by frictional forces developed between the base of footings or tank bottom and underlying crushed rock. The total frictional resistance between the tank and the underlying material is the normal force times the coefficient of friction between the crushed rock and the base of the footing and reservoir. We recommend ultimate values for the coefficient of friction of 0.50 and 0.40 for cast-in-place concrete and steel, respectively, placed over a minimum of 24 in. of compacted crushed rock fill. If additional lateral resistance is required, passive earth pressure against the perimeter footing and the walls of the tank can be computed on the basis of an equivalent fluid having a unit weight of 250 pcf for deformations equal to about 2% of the embedment depth. This passive earth pressure assumes the backfill for the footings is level for a horizontal distance equal to twice the embedment depth and is placed as granular structural fill.

Pump Slab-on-Grade

We understand that a clamshell-style pump founded on concrete slab-on-grade will be constructed southwest of the existing reservoir. We understand the foundation will have a square footprint of approximately 10 ft on a side and the applied foundation loads will be less than 500 psf. We recommend that slab founded at or above adjacent final site grades should be underlain by a minimum 8-in. thickness of 3/4-in.-minus, angular, crushed rock having less than 5% passing the No. 200 sieve (washed analysis). The crushed rock

should be compacted to at least 95% of the maximum dry density as determined by ASTM D698. Prior to placing the crushed rock structural fill, the subgrade should be evaluated by a qualified geotechnical engineer or engineering geologist. Any soft areas should be overexcavated to firm soil and backfilled with crushed rock.

Slab settlement under the conditions stated above will be less than 1 in. for this loading and configuration. Recommendations for resistance to lateral loads are provided in the "Reservoir Foundation Support and Settlement" section of this report.

Slope Stability Analysis

Slope stability analyses were completed to evaluate the potential risk of local slope instability affecting the proposed reservoir and to establish the maximum inclination of the new cut slopes. The cross section of the slope that was used to develop the slope stability models is oriented in a general northwest-southeast direction through the center of the planned reservoir. The slope stability analysis was completed using a generalized limit equilibrium (GLE) analysis with the assistance of the Slide Version 7.0 software developed by Rocscience, Inc. of Toronto, Ontario, Canada. Basic input for the models included the existing topography and proposed grading provided to GRI by MSA; subsurface profiles disclosed by the subsurface investigations completed by GRI; correlations of soil strengths to N-values obtained during drilling; material properties determined from Torvane shear strength tests, unconfined compressive strength tests, an isotropically consolidated, undrained (CIU) triaxial compression test, and our experience with similar soils. In our analyses, groundwater was assumed to be present at about elevation 322 ft at the location of boring B-3 and at a depth of about 1 ft below the toe of the proposed cut slope.

Factors of safety against sliding were computed using Spencer's Method of Slices, which satisfies both force and moment equilibrium while assuming the resultant of interslice forces are of constant orientation throughout the sliding mass. The computed factor of safety is defined as the ratio of the forces (or moments) tending to resist sliding to the forces (or moments) tending to cause sliding within the slope. Computed factors of safety less than 1.0 indicate instability or incipient slope movement. In our opinion, slopes not supporting critical structures can be designed to have an estimated factor of safety of at least 1.3 under static loading conditions. The toe of the cut slope will be separated from the reservoir by the access road and, therefore, can be considered a non-critical structure. As shown on Figures 4 and 5, a minimum static factor of safety of about 2.0 and 1.8 against instability was computed for a cut slope inclination of 2.5H:1V for both short-term (i.e., construction cases) and long-term cases. The results of our analyses are consistent with our observations of the existing 2.5H:1V cut slope located north of the existing reservoir, as the slope at this locations appears to be performing adequately and has no obvious visible indications surficial or ongoing deep-seated instability. Figures 4 and 5 show the groundwater level and locations/boundaries of soil units and associated physical properties used in our static slope stability models.

A simplified Newmark methodology analysis was completed to estimate possible lateral displacement of the cut slope as a result of seismic loading. The simplified Newmark analysis was completed using the GLE model described above and the procedure described by Bray and Travasarou (2007). In the seismic analysis, the shear strengths of the near-surface soils were reduced by 20% to account for strength loss during cyclic loading conditions. A horizontal pseudo-static, k_h, acceleration was added to the GLE model to bring the calculated factor of safety to 1.0. The k_h acceleration at a factor of safety of 1.0 is considered the "yield acceleration" and based on the results of our analysis; the computed yield acceleration is equal to 0.17g.

The yield acceleration, along with the fundamental period of the sliding mass, and the spectral acceleration are inputs into the simplified Newmark analysis. Based on this analysis, we estimate that lateral deformations of the proposed 2.5H:1V cut slope as a result of the code-based earthquake will be on the order of ½ to 1 ft. In our opinion, the risk that this amount of slope movement poses a low risk of damage to the proposed reservoir, given the planned access road separating the reservoir from the toe of the cut slope.

The slope located downhill (south) of the proposed reservoir is inclined at about 5.5H:1V. Given the relatively flat slopes, the risk of damage to the proposed reservoir caused by slope movement downhill of the proposed reservoir is considered low. Likewise, damage to the proposed reservoir caused by movement of the large landslide to the north/northeast is unlikely unless the area of the landslide expands significantly to the south.

DESIGN REVIEW AND CONSTRUCTION SERVICES

We welcome the opportunity to review and discuss construction plans and specifications for this project as they are being developed. In addition, GRI should be retained to review all geotechnical-related portions of the plans and specifications to evaluate whether they are in conformance with the recommendations provided in our report. Additionally, to observe compliance with the intent of our recommendations, design concepts, and the plans and specifications, we are of the opinion that all construction operations dealing with earthwork and foundations should be observed by a GRI representative. Our construction-phase services will allow for timely design changes if site conditions are encountered that are different from those described in this report. If we do not have the opportunity to confirm our interpretations, assumptions, and analyses during construction, we cannot be responsible for the application of our recommendations to subsurface conditions that are different from those described in this report.

LIMITATIONS

This report has been prepared to aid the project team in the planning and design of this project. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects of the project relevant to earthwork and design and construction of the new reservoir. In the event that changes in the design and location of improvements as outlined in this report are planned, we should be given the opportunity to review the changes and to modify or reaffirm the conclusions and recommendations of this report in writing.

The conclusions and recommendations submitted in this report are based on the data obtained from the borings made at the locations indicated on Figure 2 and from other sources of information discussed in this report. In the performance of subsurface investigations, specific information is obtained at specific locations at specific times. However, it is acknowledged that variations in soil may exist between exploration locations. This report does not reflect variations that may occur between these explorations. The nature and extent of variation may not become evident until construction. If, during construction, subsurface conditions differ from those encountered in the explorations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Submitted for GRI,

(10/27/17) Renews 03/2018

Matthew S. Shanahan, PE
Principal

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Senior Engineer

This document has been submitted electronically.

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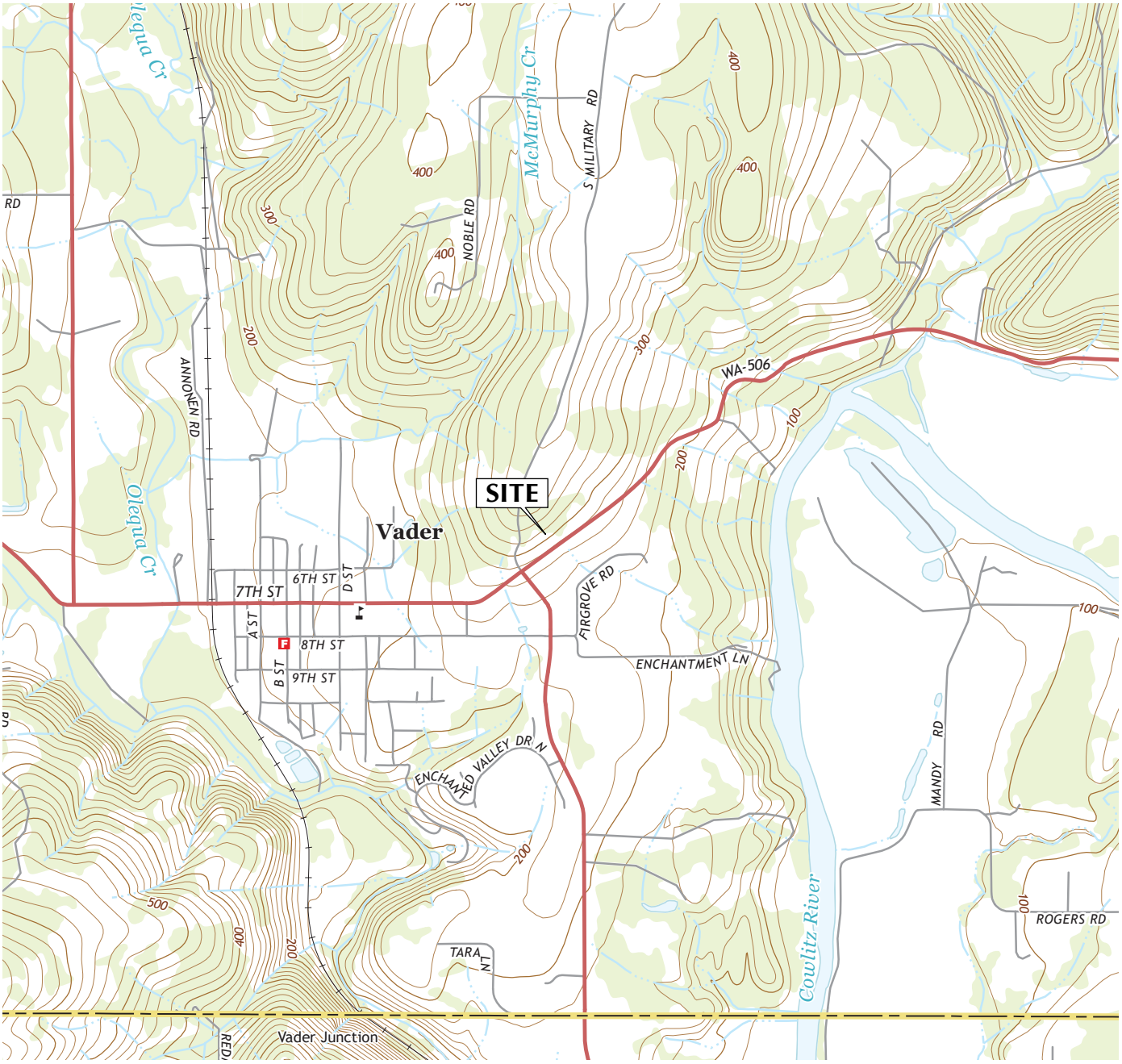


USGS TOPOGRAPHIC MAP
WINLOCK, WASH. (2013)

North

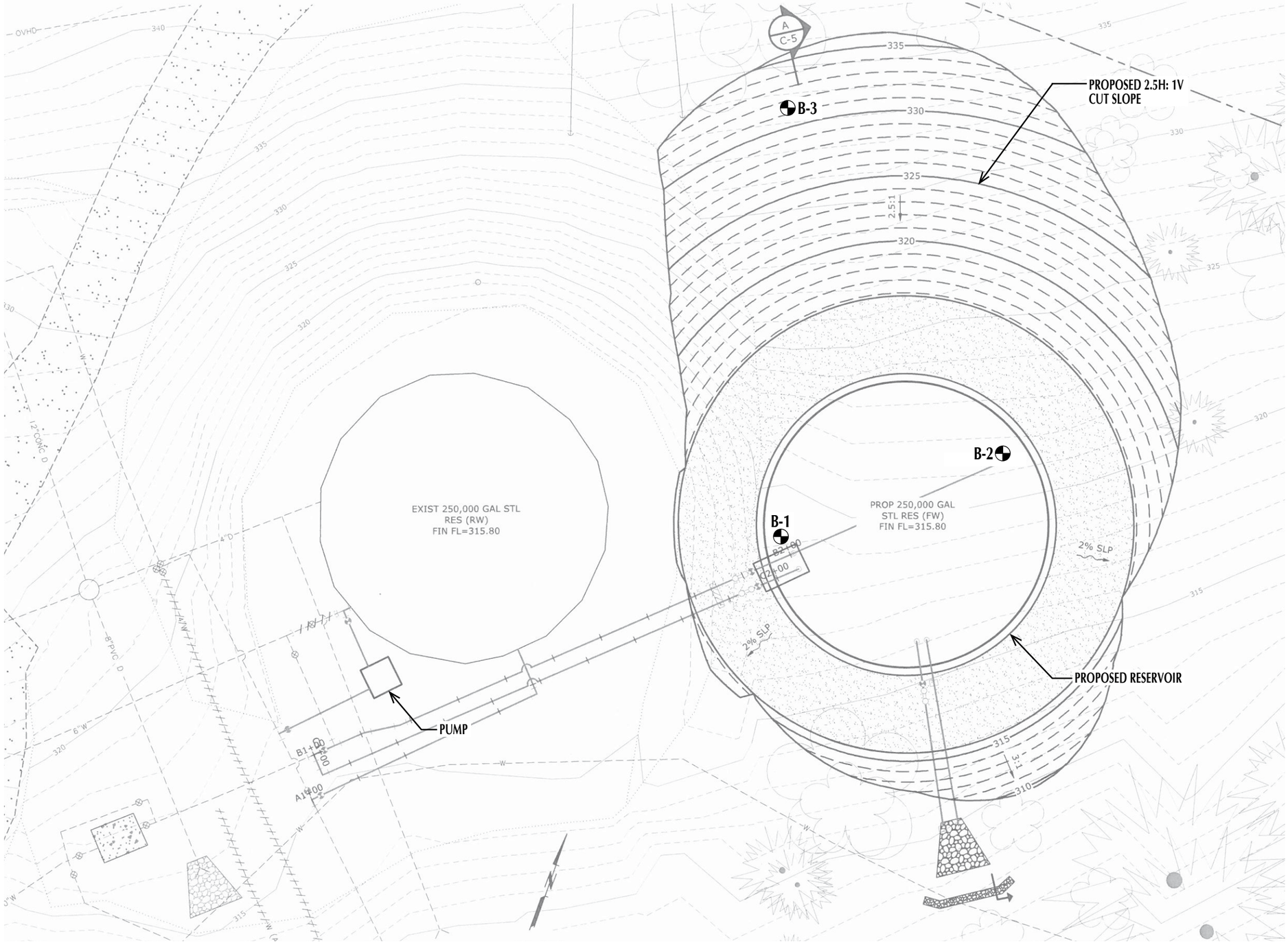
0 1/2 1 MILE

GRI

MURRAYSMITH
VADER-ENCHANTED VALLEY WATER RESERVOIR

VICINITY MAP

OCT. 2017 JOB NO. W1204 FIG. 1



BORING COMPLETED BY GRI
(SEPTEMBER 26 - 28, 2016)

SITE PLAN FROM FILE BY MURRAYSMITH, DATED SEPTEMBER 2017

North

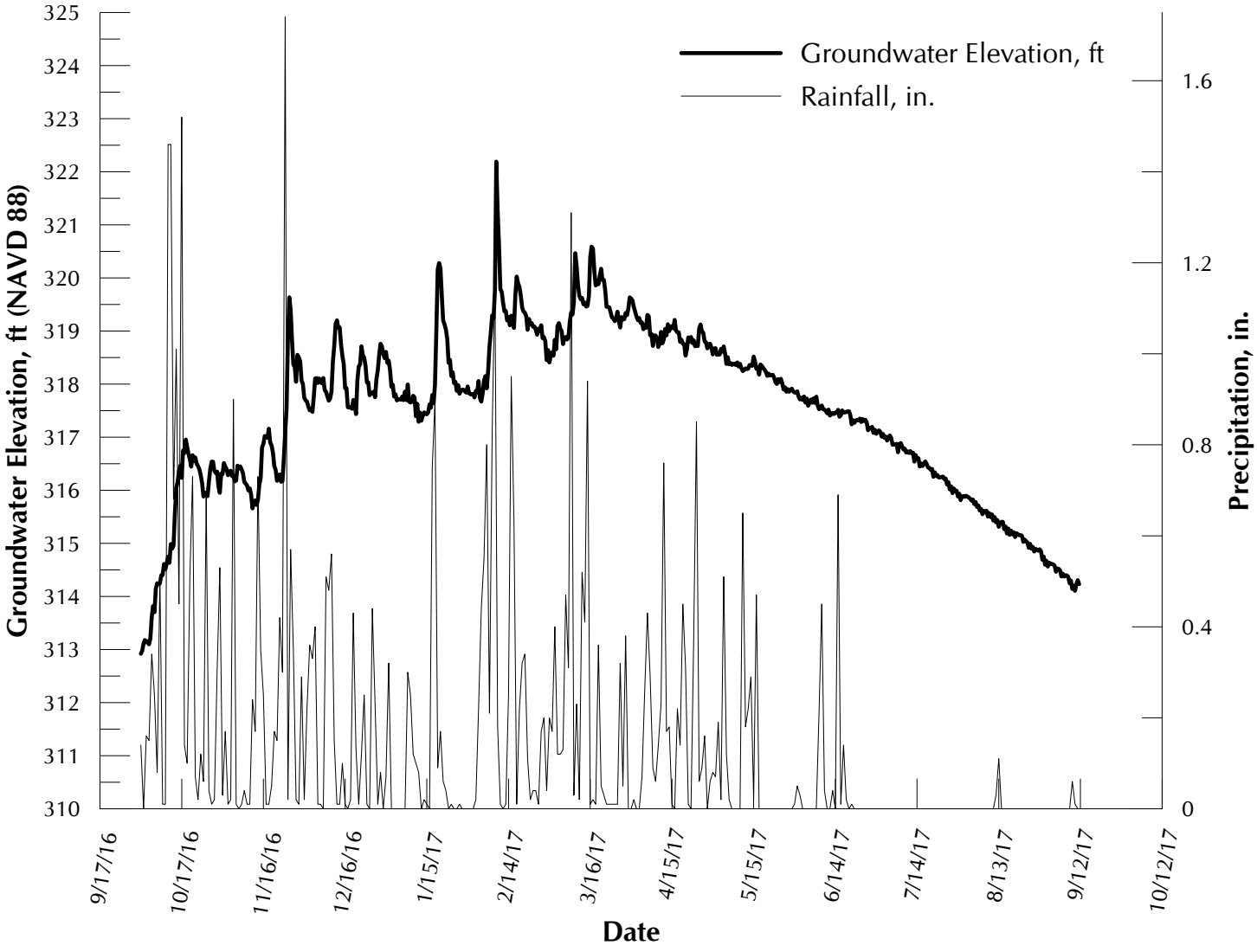
0 20 40 FT

GRI

MURRAYSMITH
VADER-ENCHANTED VALLEY WATER RESERVOIR

SITE PLAN

OCT. 2017 JOB NO. W1204 FIG. 2



NOTE: Piezometer was installed in boring B-3 at elevation 313 ft (NAVD 88) on September 27, 2016. Groundwater was below piezometer level prior to October 3, 2016. The ground surface elevation at boring B-3 is 333 ft.

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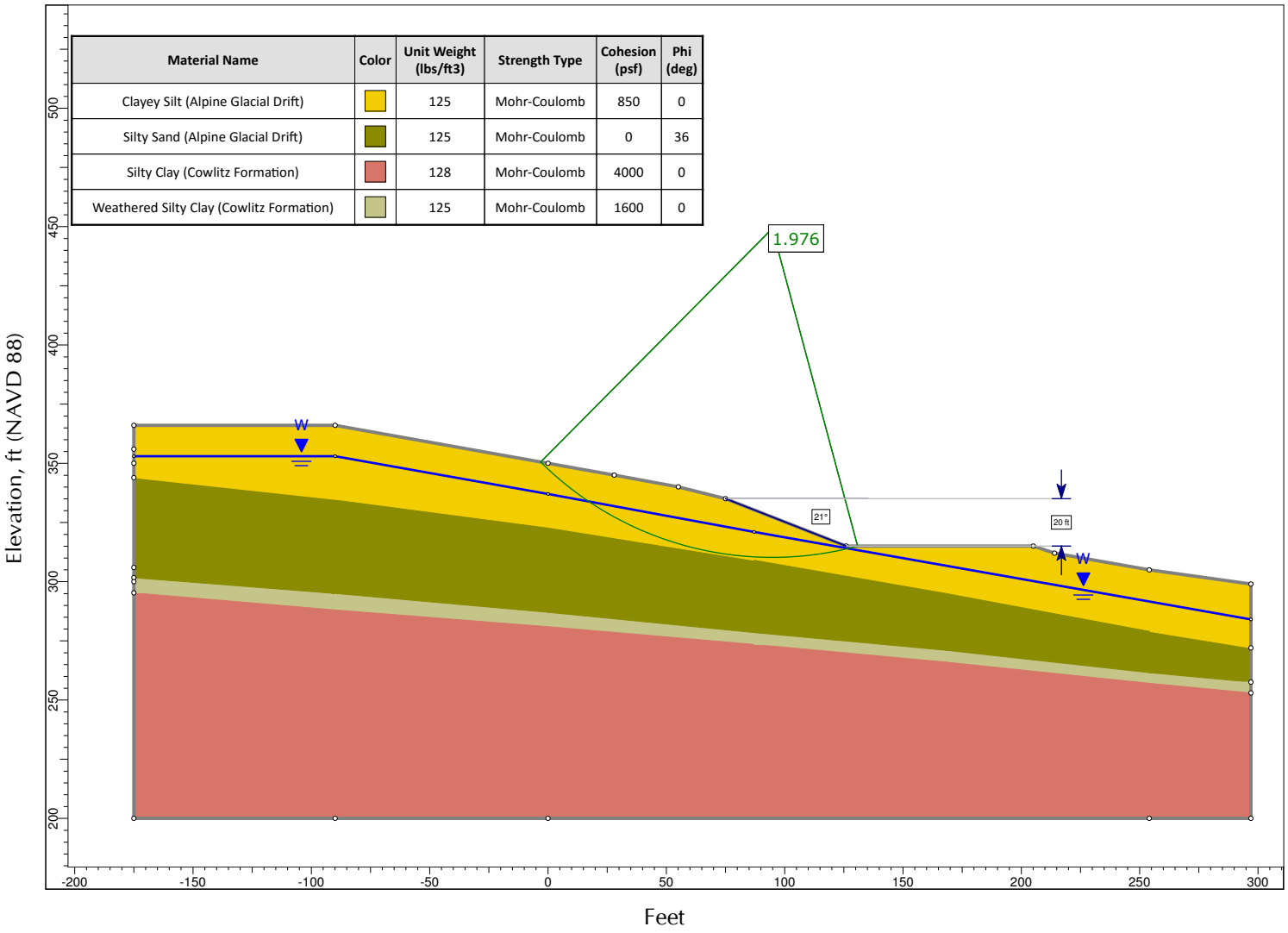
GROUNDWATER DATA

OCT. 2017 JOB NO. W1204 FIG. 3

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Silt (Alpine Glacial Drift)		125	Mohr-Coulomb	850	0
Silty Sand (Alpine Glacial Drift)		125	Mohr-Coulomb	0	36
Silty Clay (Cowlitz Formation)		128	Mohr-Coulomb	4000	0
Weathered Silty Clay (Cowlitz Formation)		125	Mohr-Coulomb	1600	0



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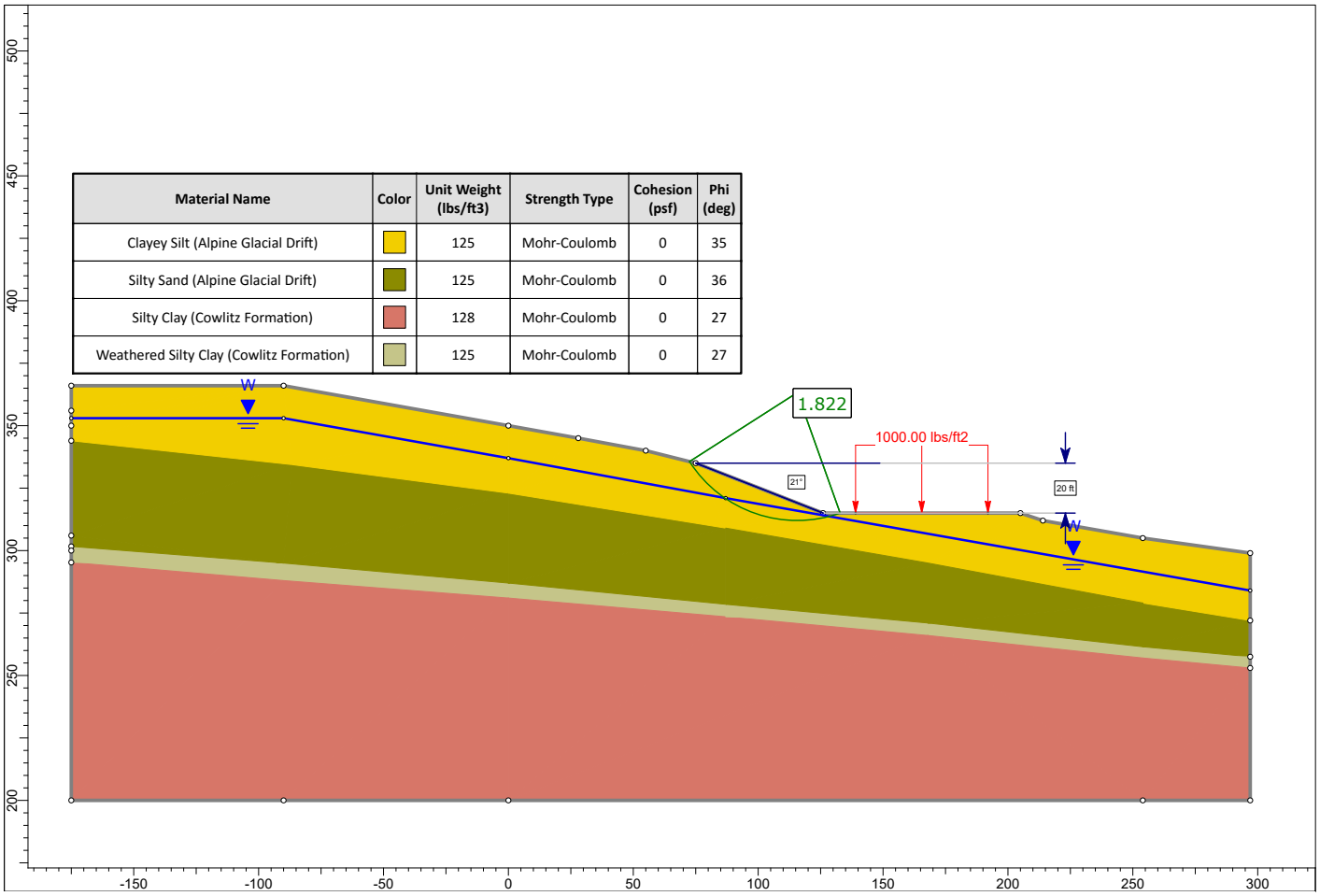
SLOPE STABILITY MODEL
(CONSTRUCTION LOADING - UNDRAINED)

OCT. 2017 JOB NO. W1204 FIG. 4



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SLOPE STABILITY MODEL
(LONG-TERM LOADING - DRAINED)

OCT. 2017 JOB NO. W1204 FIG. 5

APPENDIX A

Field Explorations and Laboratory Testing

APPENDIX A

FIELD EXPLORATIONS AND LABORATORY TESTING

FIELD EXPLORATIONS

Subsurface materials and conditions at the site were investigated between September 26 and 28, 2016, with three borings, designated B-1 through B-3. The approximate locations of the explorations are shown on the Site Plan, Figure 2. The borings were completed using a track-mounted, mud-rotary drill rig provided and operated by Western States Soil Conservation, Inc. of Newberg, Oregon, under subcontract to GRI. An experienced geotechnical engineer from GRI directed the explorations and maintained a detailed log of the materials and conditions disclosed during the course of the work.

The borings were advanced to depths of 41.5 to 86.5 ft below the ground surface. Disturbed and undisturbed samples were typically obtained in the borings at 2.5-ft intervals of depth in the upper 15 ft and at 5-ft intervals below this depth. At the time of sampling, the Standard Penetration Test was conducted. This test consists of driving a standard split-spoon sampler into the soil a distance of 18 in. using a 140-lb hammer dropped 30 in. The number of blows required to drive the sampler the last 12 in. is known as the standard penetration resistance, or N-value. The N-values provide a measure of the relative density of granular soils, such as sand, and the relative consistency, or stiffness, of cohesive soils, such as silt. The split-spoon samples were carefully examined in the field and representative portions were saved in airtight jars. Relatively undisturbed samples of fine-grained silty and clayey, cohesive soils were obtained by pushing 3-in.-O.D. Shelby tubes into the undisturbed soil a maximum distance of 24 in. using drill rig hydraulics. The soils exposed in the ends of the Shelby tubes were examined and classified in the field. After classification, the tubes were sealed with rubber caps and tape to preserve the natural moisture content of the soils. All samples were returned to our laboratory for further examination and testing.

Logs of the borings are provided on Figures 1A through 3A. Each log presents a descriptive summary of the various types of materials encountered in the boring and notes the depth at which the materials and/or characteristics of the materials change. To the right of the descriptive summary, the depth to groundwater and the numbers and types of samples are indicated. Farther to the right, N-values are shown graphically, along with natural moisture contents, Torvane shear strengths, unconfined compressive strength shear strengths, percent passing the No. 200 sieve, and Atterberg Limits test results. The terms and symbols used to describe the soils encountered in the borings are defined in Table 1A and the attached legend.

INSTRUMENTATION

Vibrating-Wire Piezometer

A RST Instruments VW2100-0.35 vented vibrating-wire piezometer was installed in boring B-3 at 20 ft below ground surface (elevation 313 ft). The piezometer is equipped with an RST Model DT2011B single-channel data logger programmed to record data at 12-hr intervals. At the time of installation, the piezometer was saturated with water, taped to a 1-in.-O.D. PVC grout pipe in an inverted position to maintain saturation, and inserted into the open borehole to the desired depth. The boring was then filled with cement-bentonite grout to near the ground surface. The performance of each piezometer was verified before installation and immediately after insertion to design depth. The installation is equipped with a steel monument casing that was cement grouted into the borehole collar to protect the data logger and readout cables from vandalism

and the elements. The data logger is being downloaded periodically to evaluate the data. The piezometer data is summarized graphically on Figure 3.

LABORATORY TESTING

All samples obtained from the borings were returned to our laboratory, where the physical characteristics of the samples were noted and the field classifications were modified where necessary. At the time of classification, the natural moisture content of selected soil samples was determined. Additional testing included washed sieve analysis, Atterberg limit determinations, one-dimensional consolidation testing, Torvane shear strength measurements, unconfined compressive strength tests, triaxial compression testing, and dry unit weight determinations. The results of the geotechnical laboratory testing are summarized in Table 2A. The following paragraphs describe the testing program in more detail.

Natural Moisture Content

Natural moisture content determinations were made in conformance with ASTM D2216. The results are provided on Figures 1A through 3A and in Table 2A.

Grain Size (Washed-Sieve Analysis)

Washed sieve analyses were performed on selected samples to determine the percentage of material passing the No. 200 sieve. The test is performed by taking a sample of known dry weight and washing it over a No. 200 sieve. The material retained on the sieve is oven-dried and weighed, and the percentage of material passing the No. 200 sieve is calculated. The test results are provided on Figures 1A through 3A and are summarized in Table 2A.

Atterberg Limits

Atterberg limits tests were performed on two representative samples of the fine-grained silty or clayey soils in substantial conformance with ASTM D4318. The results of the tests are shown on Figures 1A and 2A; the Plasticity Chart, Figure 4A; and are summarized in Table 2A.

Torvane Shear Strength

The approximate undrained shear strength of relatively undisturbed fine-grained silty or clayey soil samples was determined using a Torvane shear device. The Torvane is a hand-held apparatus with vanes that are inserted into the soil. The torque required to fail the soil in shear around the vanes is measured using a calibrated spring. The results of the Torvane shear tests are summarized on Figure 3A.

One-Dimensional Consolidation

One-dimensional consolidation testing was performed on select samples of relatively undisturbed fine-grained silty or clayey soils from the Shelby tubes in accordance with ASTM D2435 to obtain data on the compressibility characteristics and stress history of the soil. The results of the testing are summarized on Figures 5A through 7A in the form of a curve showing effective stress versus percent strain. The initial moisture content and dry unit weight of each sample are provided on the figures.

Dry Unit Weight

The dry unit weight, or density, of four relatively undisturbed samples were determined in the laboratory in accordance with ASTM D2937 by cutting a cylindrical specimen of soil from a Shelby tube sample. The

dimensions of the specimen were carefully measured, the volume calculated, and the specimen weighed. After oven-drying, the specimen was reweighed and the water content calculated. The test results are summarized on Figures 1A and 3A and in Table 2A

Unconfined Compression

Unconfined compression testing was performed on two relatively undisturbed samples in conformance with ASTM D2166. The test is performed on a 6-in.-long section of a 2.8-in.-diameter sample, which are trimmed and placed in a load frame. Compression proceeds at rates between 1/2 and 2% strain per minute. Testing proceeds until a physical failure is observed or the load required to continue compression drops dramatically (indicating failure). The maximum load per strain-corrected area is referred to as the unconfined compressive strength. The shear strength of each sample is calculated as one-half the unconfined compressive strength. Results of the unconfined compression strength testing are summarized in Table 3A.

Table 3A - SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH DETERMINATIONS

Boring	Sample	Depth, ft	Natural Moisture Content, %	Strain at Maximum Load, %	Shear Strength, tsf	Soil Type
B-1	S-4	10.5	43	0.7	0.15	Clayey SILT, trace to some gravel, trace fine- to coarse-grained sand, brown mottled rust
B-1	S-4	11.3	42	1.5	0.45	Clayey SILT, trace to some gravel, trace fine- to coarse-grained sand, brown mottled rust

Triaxial Compression Test

One anisotropically consolidated, undrained (CIU) triaxial compression test with pore pressure measurements was performed on a representative sample of soil from boring B-3. The test sample was prepared from a relatively undisturbed 2.85-in.-I.D. Shelby tube sample. The test results are summarized on Figure 8A. A graphical summary of deviator stress, pore pressure changes, and principal effective stress ratio versus axial strain are shown from top to bottom across the left portion of the figure. The right portion of the figure shows the effective stress path for each of the load stages and the stress ratio at failure based on maximum deviator stress. Below the chart presented on the figure, is a tabular summary of the test data, including initial and final moisture content of the sample.

Table 1A

GUIDELINES FOR CLASSIFICATION OF SOIL

Description of Relative Density for Granular Soil

Relative Density	Standard Penetration Resistance (N-values) blows per ft
very loose	0 - 4
loose	4 - 10
medium dense	10 - 30
dense	30 - 50
very dense	over 50

Description of Consistency for Fine-Grained (Cohesive) Soils

Consistency	Standard Penetration Resistance (N-values) blows per ft	Torvane or Undrained Shear Strength, tsf
very soft	0 - 2	less than 0.125
soft	2 - 4	0.125 - 0.25
medium stiff	4 - 8	0.25 - 0.50
stiff	8 - 15	0.50 - 1.0
very stiff	15 - 30	1.0 - 2.0
hard	over 30	over 2.0

Grain-Size Classification	Modifier for Subclassification		
Boulders:		**Primary Constituent SAND or GRAVEL**	**Primary Constituent SILT or CLAY**
> 12 in.	**Adjective**	**Percentage of Other Material (by weight)**	
Cobbles:			
3 - 12 in.	trace:	5 - 15 (sand, gravel)	5 - 15 (sand, gravel)
Gravel:	some:	15 - 30 (sand, gravel)	15 - 30 (sand, gravel)
1/4 - 3/4 in. (fine)	sandy, gravelly:	30 - 50 (sand, gravel)	30 - 50 (sand, gravel)
3/4 - 3 in. (coarse)			
Sand:	trace:	< 5 (silt, clay)	*Relationship of clay and silt determined by plasticity index test*
No. 200 - No. 40 sieve (fine)	some:	5 - 12 (silt, clay)	
No. 40 - No. 10 sieve (medium)	silty, clayey:	12 - 50 (silt, clay)	
No. 10 - No. 4 sieve (coarse)			
Silt/Clay:			
pass No. 200 sieve			

GRI

Table 2A

SUMMARY OF LABORATORY RESULTS

Sample Information						Atterberg Limits			
Location	Sample	Depth, ft	Elevation, ft	Moisture Content, %	Dry Unit Weight, pcf	Liquid Limit, %	Plasticity Index, %	Fines Content, %	Soil Type
B-1	S-1	2.5	316.5	25	--	48	17	--	Clayey SILT
	S-2	5.0	314.0	29	--	--	--	--	Clayey SILT
	S-3	7.5	311.5	36	--	--	--	56	Clayey SILT
	S-4	10.0	309.0	40	--	--	--	--	Clayey SILT
	S-4	10.5	308.5	38	85	--	--	--	Clayey SILT
	S-4	11.3	307.7	44	78	--	--	--	Clayey SILT
	S-5	12.0	307.0	55	--	--	--	84	Clayey SILT
	S-6	15.0	304.0	54	--	--	--	--	Clayey SILT
	S-7	20.0	299.0	55	--	--	--	--	Clayey SILT
	S-8	26.5	292.5	39	--	--	--	--	Silty SAND
	S-9	27.0	292.0	34	--	--	--	38	Silty SAND
	S-10	30.0	289.0	44	--	--	--	--	Silty SAND
	S-11	35.0	284.0	30	--	--	--	27	Silty SAND
	S-12	40.0	279.0	35	--	--	--	--	Silty SAND
B-2	S-1	2.5	318.5	25	--	--	--	85	Clayey SILT
	S-2	5.0	316.0	25	--	--	--	--	Clayey SILT
	S-3	7.5	313.5	33	--	--	--	--	Clayey SILT
	S-4	10.0	311.0	39	--	--	--	--	Clayey SILT
	S-5	13.0	308.0	31	--	--	--	--	Clayey SILT
	S-5	13.5	307.5	32	89	--	--	--	Clayey SILT
	S-6	14.5	306.5	43	--	--	--	65	Clayey SILT
	S-7	20.0	301.0	56	--	--	--	--	Clayey SILT
	S-8	25.0	296.0	42	--	--	--	33	Silty SAND
	S-9	30.0	291.0	41	--	--	--	43	Silty SAND
	S-10	35.0	286.0	37	--	--	--	--	Silty SAND
	S-11	40.0	281.0	45	--	--	--	49	Silty SAND
	S-12	45.0	276.0	31	--	--	--	--	Silty SAND
	S-13	50.0	271.0	52	--	--	--	99	Silty CLAY
	S-14	55.0	266.0	30	--	65	36	99	Silty CLAY
	S-15	60.0	261.0	32	--	--	--	--	Silty CLAY
	S-16	65.0	256.0	34	--	--	--	--	Silty CLAY
	S-17	70.0	251.0	32	--	--	--	--	Silty CLAY
B-3	S-1	2.5	330.5	25	--	--	--	81	Clayey SILT
	S-2	6.0	327.0	31	--	--	--	--	Clayey SILT
	S-3	7.0	326.0	41	--	--	--	--	Clayey SILT
	S-4	10.0	323.0	54	--	--	--	--	Clayey SILT
	S-5	12.7	320.3	41	--	--	--	--	Clayey SILT
	S-5	13.6	319.4	50	70	--	--	--	Clayey SILT
	S-6	14.5	318.5	59	--	--	--	--	Clayey SILT
	S-7	20.0	313.0	49	--	--	--	--	Clayey SILT

Table 2A

SUMMARY OF LABORATORY RESULTS

Sample Information						Atterberg Limits			
Location	Sample	Depth, ft	Elevation, ft	Moisture Content, %	Dry Unit Weight, pcf	Liquid Limit, %	Plasticity Index, %	Fines Content, %	Soil Type
B-3	S-8	25.0	308.0	52	--	--	--	50	Sandy SILT
	S-10	35.0	298.0	48	--	--	--	48	Silty SAND
	S-13	45.0	288.0	35	--	--	--	37	Silty SAND
	S-14	50.0	283.0	37	--	--	--	--	Silty SAND
	S-15	55.0	278.0	41	--	--	--	98	Silty CLAY
	S-16	60.0	273.0	29	--	--	--	99	Silty CLAY
	S-18	70.0	263.0	27	--	--	--	--	Silty CLAY
	S-19	75.0	258.0	28	--	--	--	--	Silty CLAY
	S-20	80.0	253.0	29	--	--	--	--	Silty CLAY
	S-21	85.0	248.0	31	--	--	--	--	Silty CLAY

BORING AND TEST PIT LOG LEGEND

SOIL SYMBOLS

Symbol	Typical Description
	LANDSCAPE MATERIALS
	FILL
	GRAVEL; clean to some silt, clay, and sand
	Sandy GRAVEL; clean to some silt and clay
	Silty GRAVEL; up to some clay and sand
	Clayey GRAVEL; up to some silt and sand
	SAND; clean to some silt, clay, and gravel
	Gravelly SAND; clean to some silt and clay
	Silty SAND; up to some clay and gravel
	Clayey SAND; up to some silt and gravel
	SILT; up to some clay, sand, and gravel
	Gravelly SILT; up to some clay and sand
	Sandy SILT; up to some clay and gravel
	Clayey SILT; up to some sand and gravel
	CLAY; up to some silt, sand, and gravel
	Gravelly CLAY; up to some silt and sand
	Sandy CLAY; up to some silt and gravel
	Silty CLAY; up to some sand and gravel
	PEAT

BEDROCK SYMBOLS

Symbol	Typical Description
	BASALT
	MUDSTONE
	SILTSTONE
	SANDSTONE

SURFACE MATERIAL SYMBOLS

Symbol	Typical Description
	Asphalt concrete PAVEMENT
	Portland cement concrete PAVEMENT
	Crushed rock BASE COURSE

SAMPLER SYMBOLS

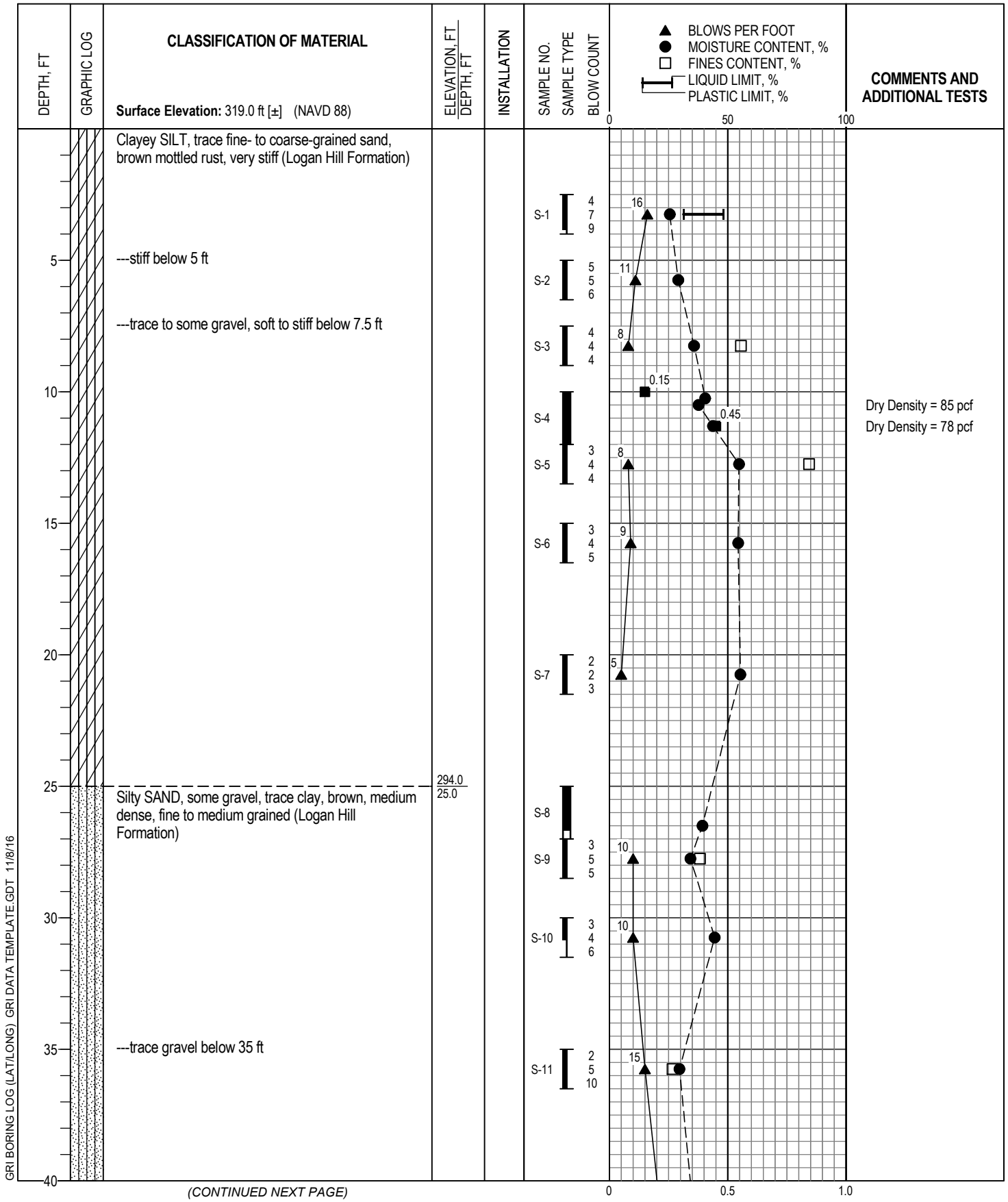
Symbol	Sampler Description
	2.0-in. O.D. split-spoon sampler and Standard Penetration Test with recovery (ASTM D1586)
	Shelby tube sampler with recovery (ASTM D1587)
	3.0-in. O.D. split-spoon sampler with recovery (ASTM D3550)
	Grab Sample
	Rock core sample interval
	Sonic core sample interval
	Geoprobe sample interval

INSTALLATION SYMBOLS

Symbol	Symbol Description
	Flush-mount monument set in concrete
	Concrete, well casing shown where applicable
	Bentonite seal, well casing shown where applicable
	Filter pack, machine-slotted well casing shown where applicable
	Grout, vibrating-wire transducer cable shown where applicable
	Vibrating-wire pressure transducer
	1-in.-diameter solid PVC
	1-in.-diameter hand-slotted PVC
	Grout, inclinometer casing shown where applicable

FIELD MEASUREMENTS

Symbol	Typical Description
	Groundwater level during drilling and date measured
	Groundwater level after drilling and date measured
	Rock core recovery
	Rock quality designation (RQD)

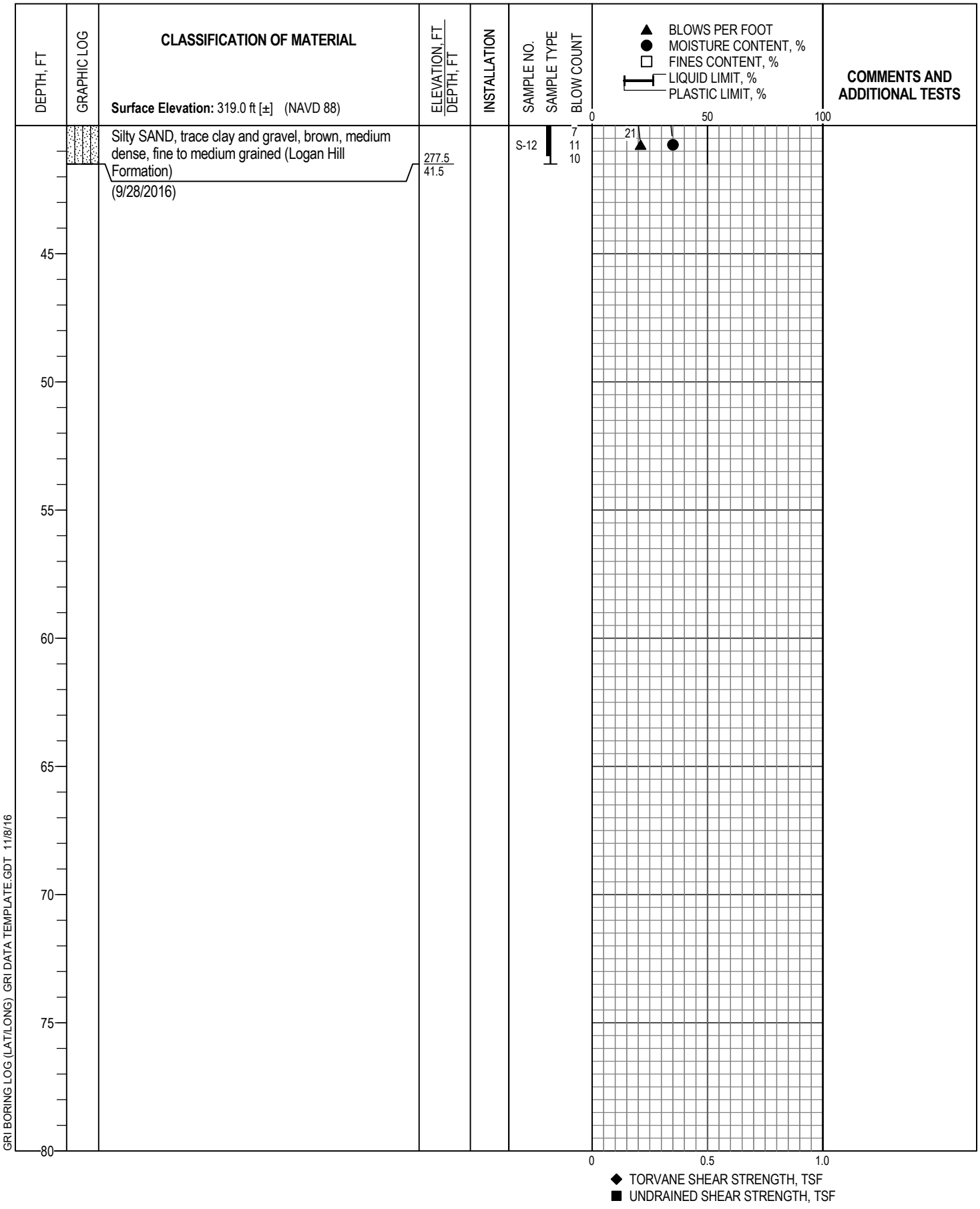


GRI BORING LOG (LAT/LONG) GRI DATA TEMPLATE.GDT 11/8/16

Logged By: S. Reddy	**Drilled by:** Western States Soil Conservation, Inc.
Date Started: 9/28/16	**Coordinates:** 46.40449° N 122.94576° W (WGS84)
Drilling Method: Mud Rotary **Equipment:** CME 850 Track-Mounted Drill Rig **Hole Diameter:** 4.875	**Hammer Type:** Auto Hammer **Weight:** 140 lb **Drop:** 30 in. **Energy Ratio:** 89%
Note: See Legend for Explanation of Symbols	

BORING B-1

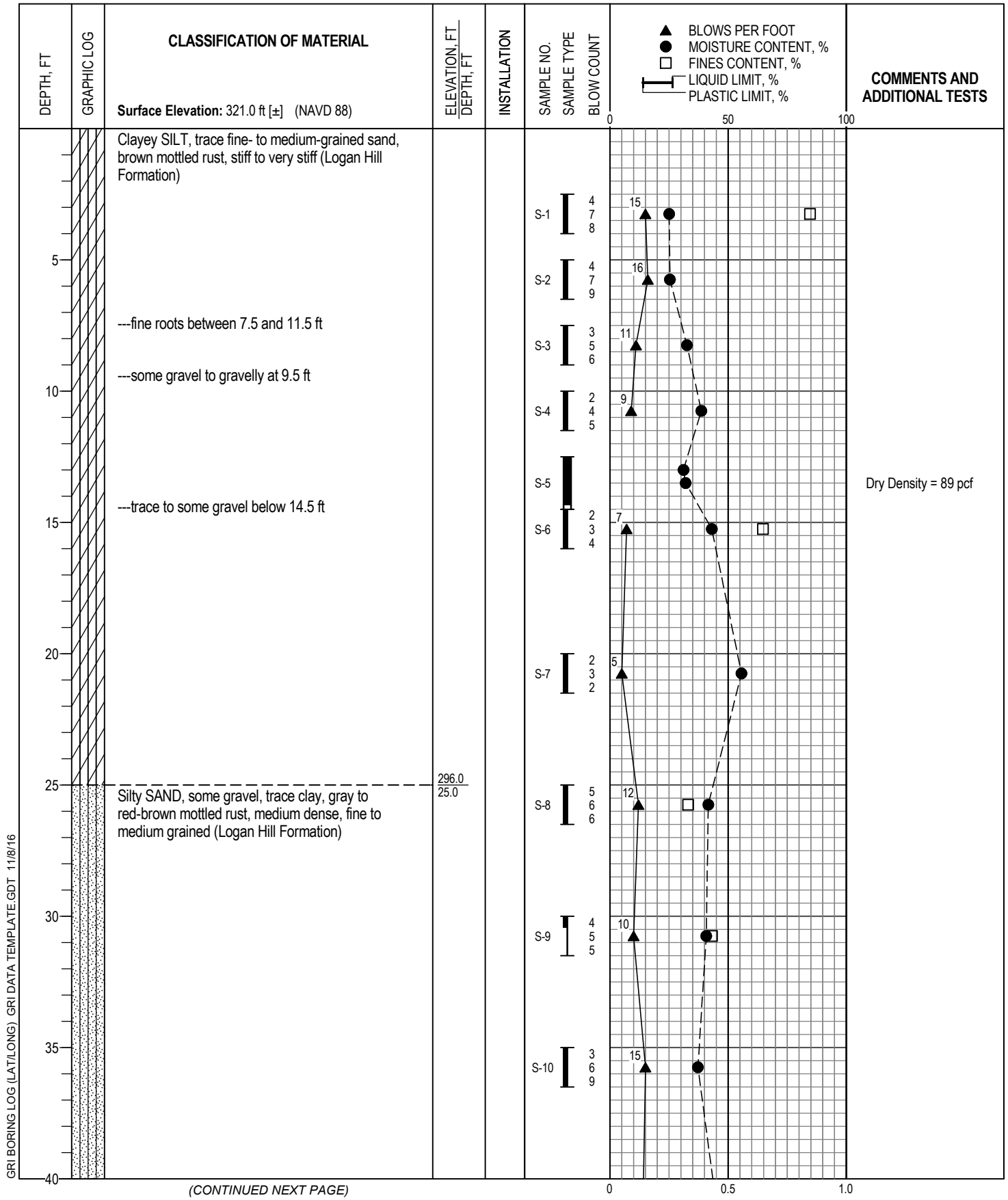
OCT. 2017 JOB NO. W1204 FIG. 1A



GRI BORING LOG (LAT/LONG) GRI DATA TEMPLATE.GDT 11/8/16

BORING B-1

OCT. 2017 JOB NO. W1204 FIG. 1A



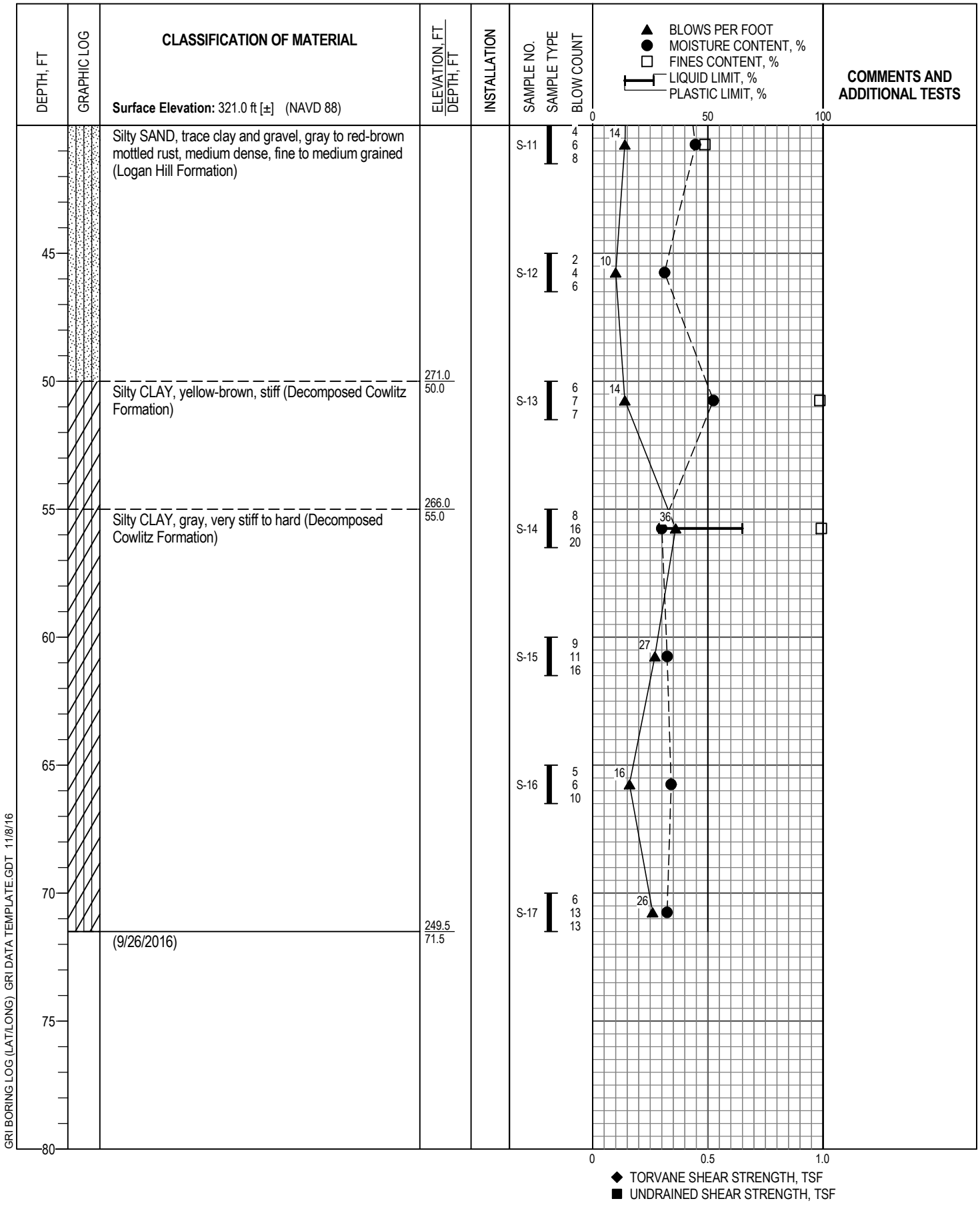
(CONTINUED NEXT PAGE)

GRI BORING LOG (LAT/LONG) GRI DATA TEMPLATE.GDT 11/8/16

Logged By: S. Reddy	**Drilled by:** Western States Soil Conservation, Inc.
Date Started: 9/26/16	**Coordinates:** 46.40467° N 122.9457° W (WGS84)
Drilling Method: Mud Rotary **Equipment:** CME 850 Track-Mounted Drill Rig **Hole Diameter:** 4.875	**Hammer Type:** Auto Hammer **Weight:** 140 lb **Drop:** 30 in. **Energy Ratio:** 89%
Note: See Legend for Explanation of Symbols	

BORING B-2

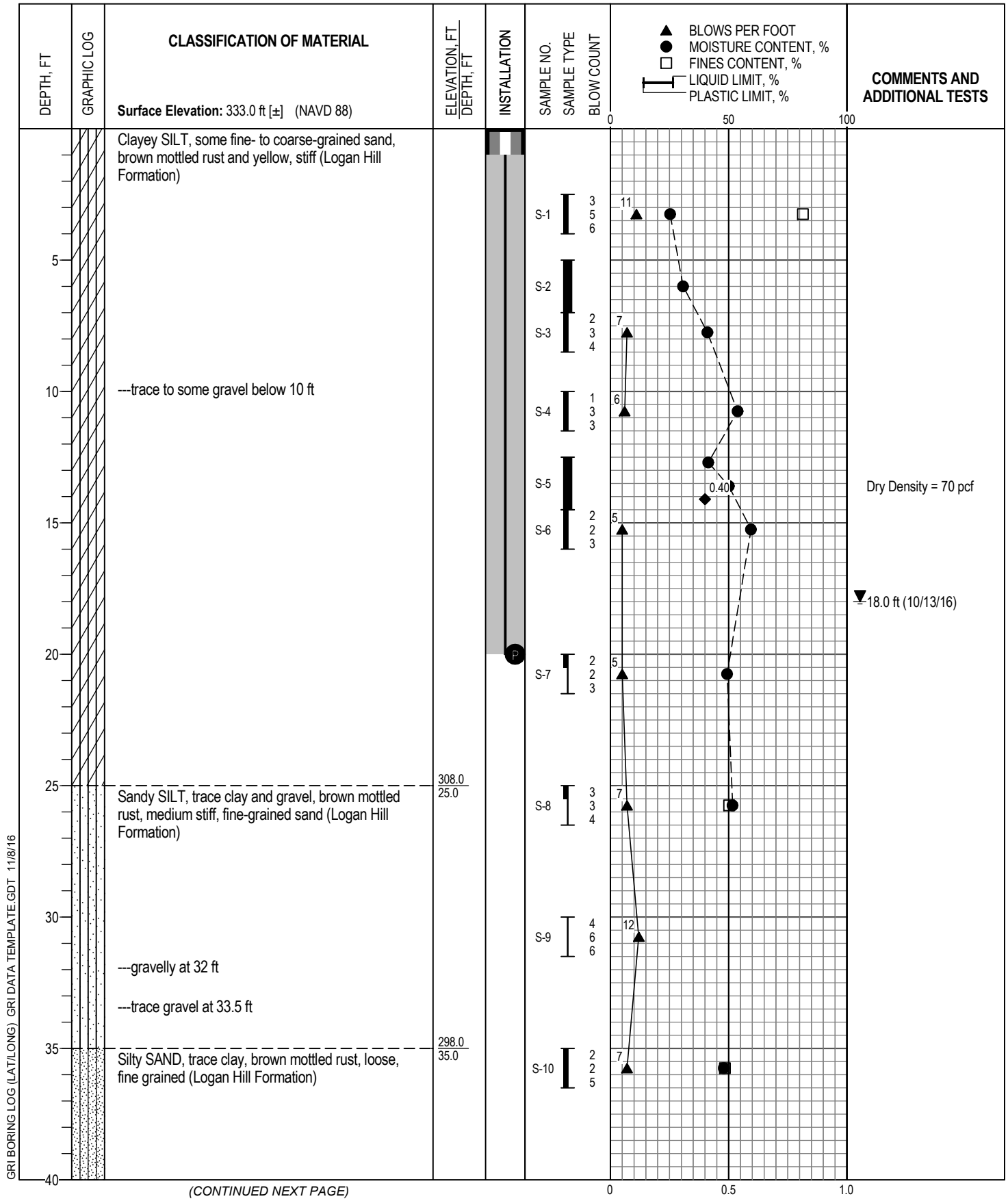
OCT. 2017 JOB NO. W1204 FIG. 2A



GRI BORING LOG (LAT/LONG) GRI DATA TEMPLATE.GDT 11/8/16

BORING B-2

OCT. 2017 JOB NO. W1204 FIG. 2A

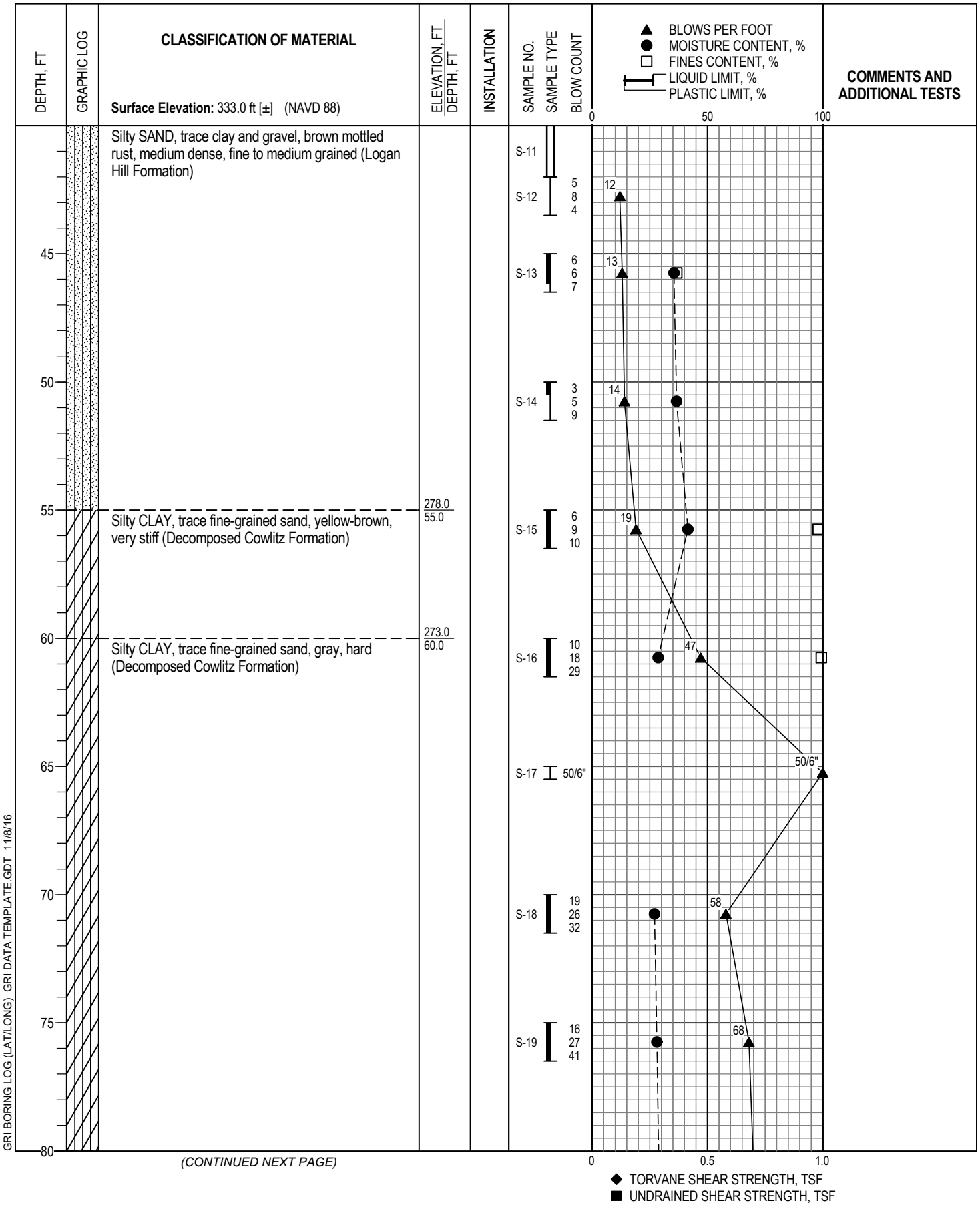


GRI BORING LOG (LAT/LONG) GRI DATA TEMPLATE.GDT 11/8/16

Logged By: S. Reddy	**Drilled by:** Western States Soil Conservation, Inc.
Date Started: 9/27/16	**Coordinates:** 46.40474° N 122.94585° W (WGS84)
Drilling Method: Mud Rotary **Equipment:** CME 850 Track-Mounted Drill Rig **Hole Diameter:** 4.875	**Hammer Type:** Auto Hammer **Weight:** 140 lb **Drop:** 30 in. **Energy Ratio:** 89%
Note: See Legend for Explanation of Symbols	

BORING B-3

OCT. 2017 JOB NO. W1204 FIG. 3A

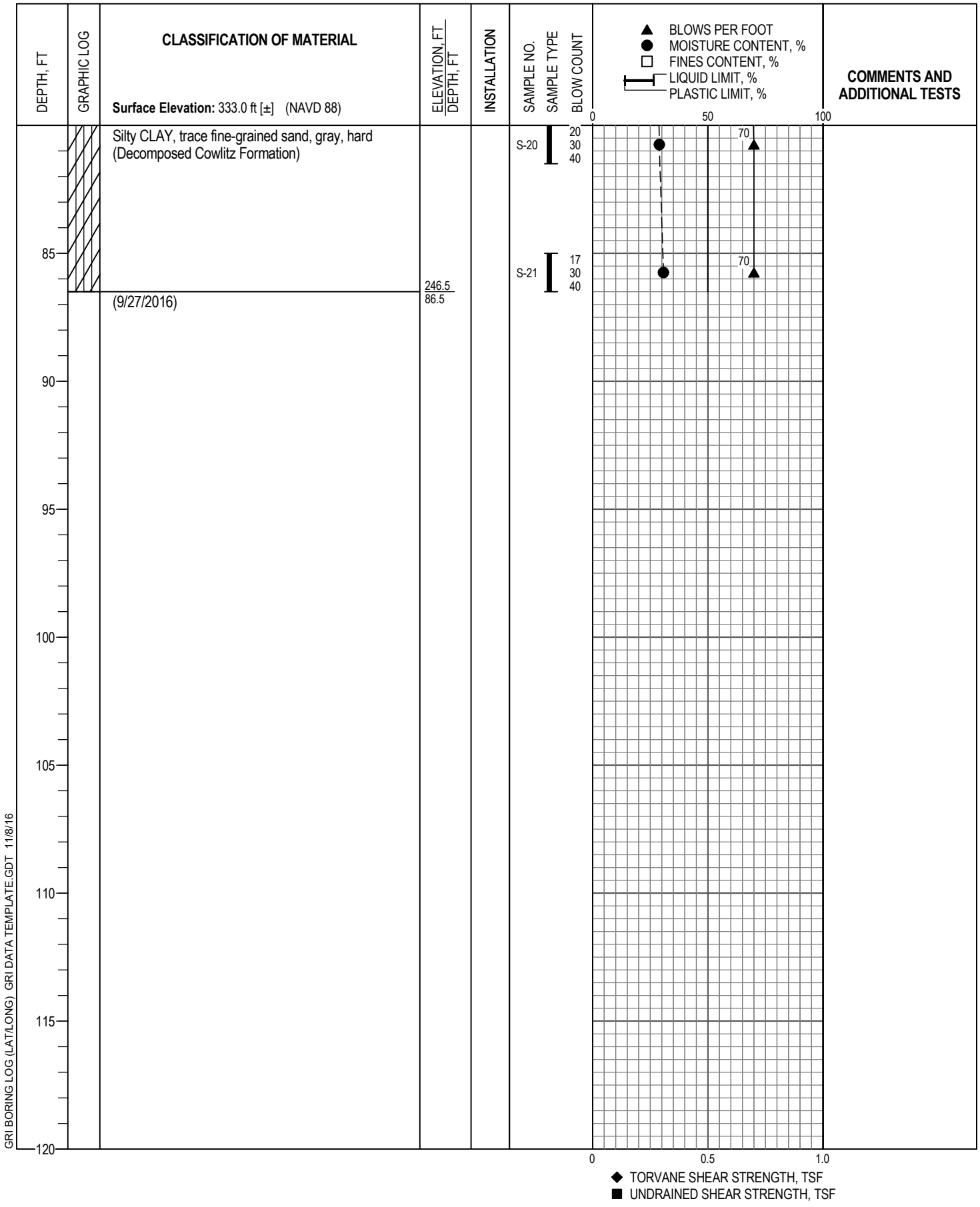


(CONTINUED NEXT PAGE)

GRI BORING LOG (LAT/LONG) GRI DATA TEMPLATE.GDT 11/8/16

BORING B-3

OCT. 2017 JOB NO. W1204 FIG. 3A



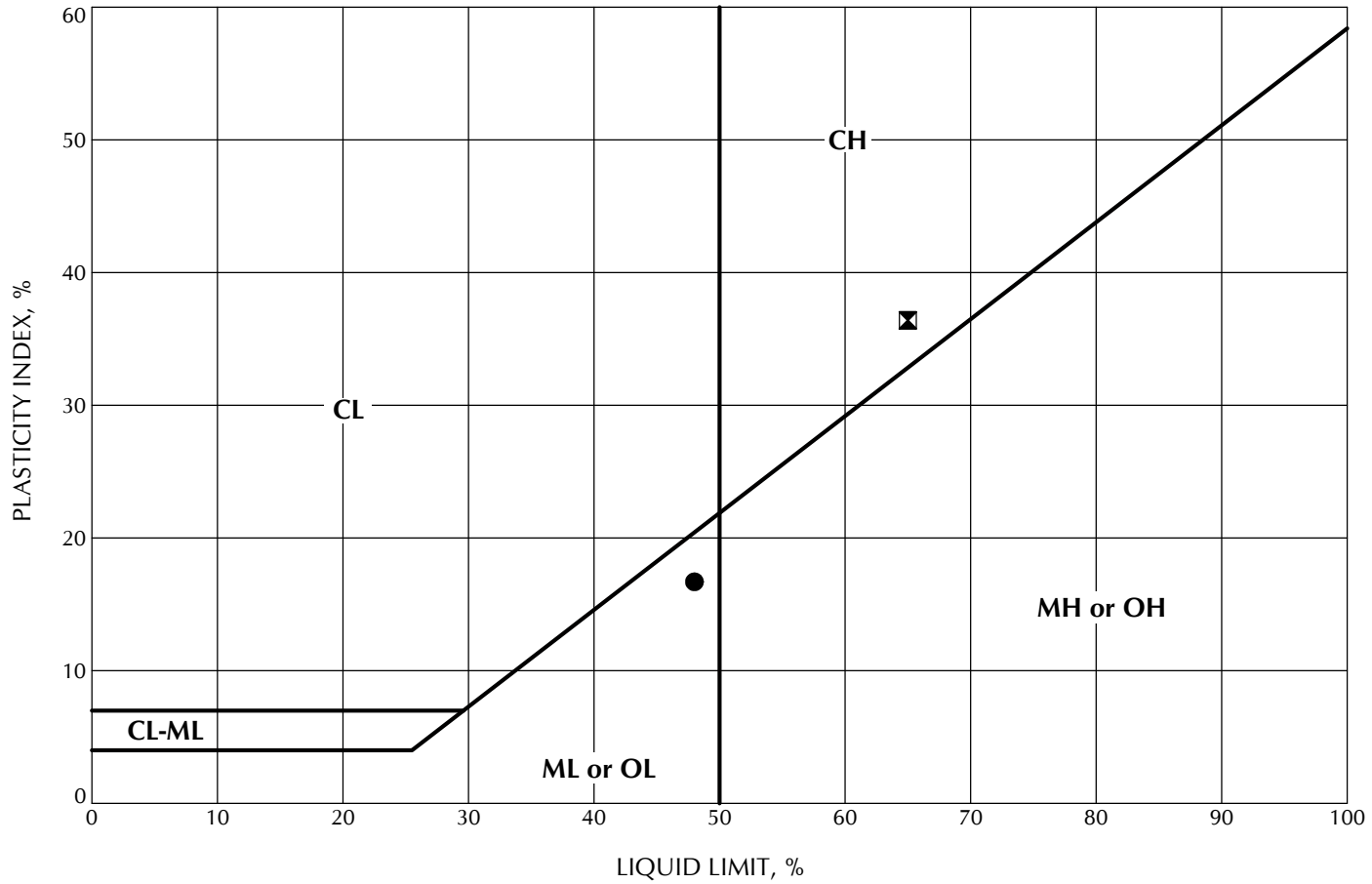
GRI BORING LOG (LAT/LONG) GRI DATA TEMPLATE.GDT 11/8/16

BORING B-3

OCT. 2017 JOB NO. W1204 FIG. 3A

GROUP SYMBOL	UNIFIED SOIL CLASSIFICATION FINE-GRAINED SOIL GROUPS
OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
ML	INORGANIC CLAYEY SILTS TO VERY FINE SANDS OF SLIGHT PLASTICITY
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY

GROUP SYMBOL	UNIFIED SOIL CLASSIFICATION FINE-GRAINED SOIL GROUPS
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
MH	INORGANIC SILTS AND CLAYEY SILT
CH	INORGANIC CLAYS OF HIGH PLASTICITY



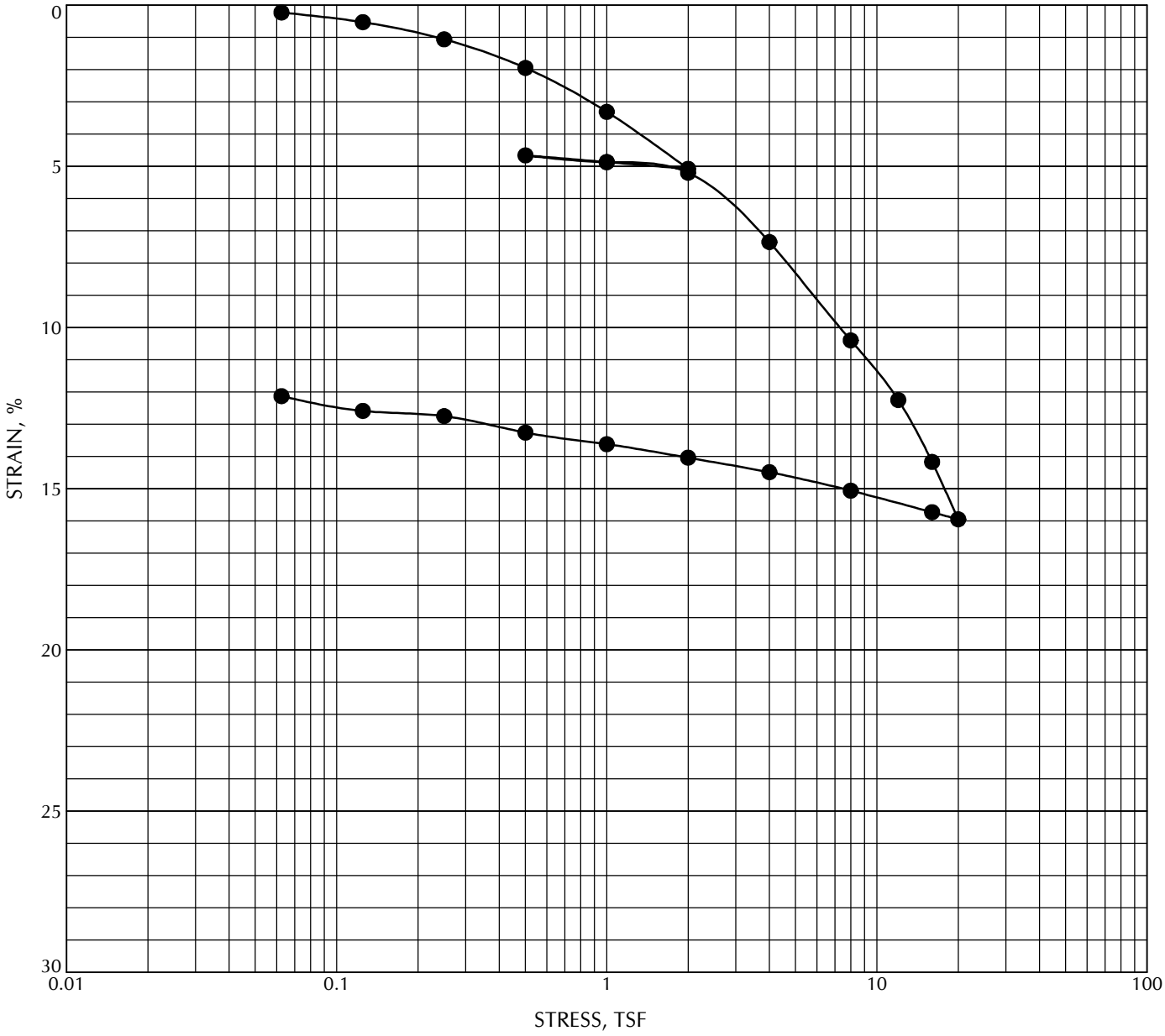
	Location	Sample	Depth, ft	Classification	LL	PL	PI	MC, %
●	B-1	S-1	2.5	Clayey SILT, trace fine- to coarse-grained sand, brown mottled rust (Logan Hill Formation)	48	31	17	25
⊠	B-2	S-14	55.0	Silty CLAY, gray (Decomposed Cowlitz Formation)	65	29	36	30

ATTERBERG-PLASTICITY 2 PER PAGE GRI DATA TEMPLATE.GDT 11/8/16

GRI

PLASTICITY CHART

OCT. 2017 JOB NO. W1204 FIG. 4A



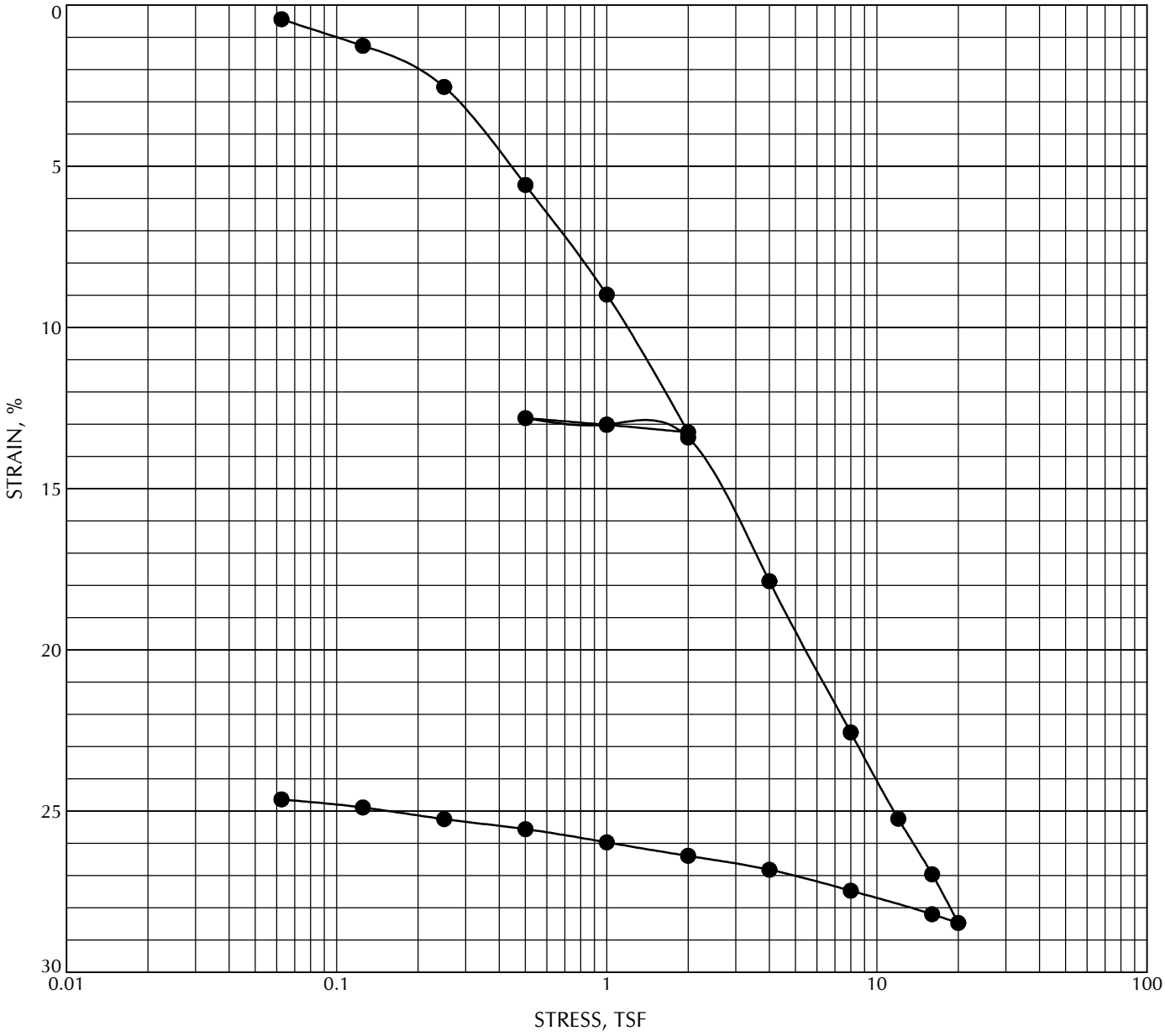
	Location	Sample	Depth, ft	Classification	Initial γ_d, pcf	Initial MC, %
●	B-2	S-5	14.0	Clayey SILT, some gravel to gravelly, trace fine- to medium-grained sand, brown mottled rust (Logan Hill Formation)	89	32

CONSOL STRAIN GRI - 0 TO 30-1PER PAGE GRI DATA TEMPLATE.GDT 11/8/16

GRI

CONSOLIDATION TEST

OCT. 2017 JOB NO. W1204 FIG. 5A



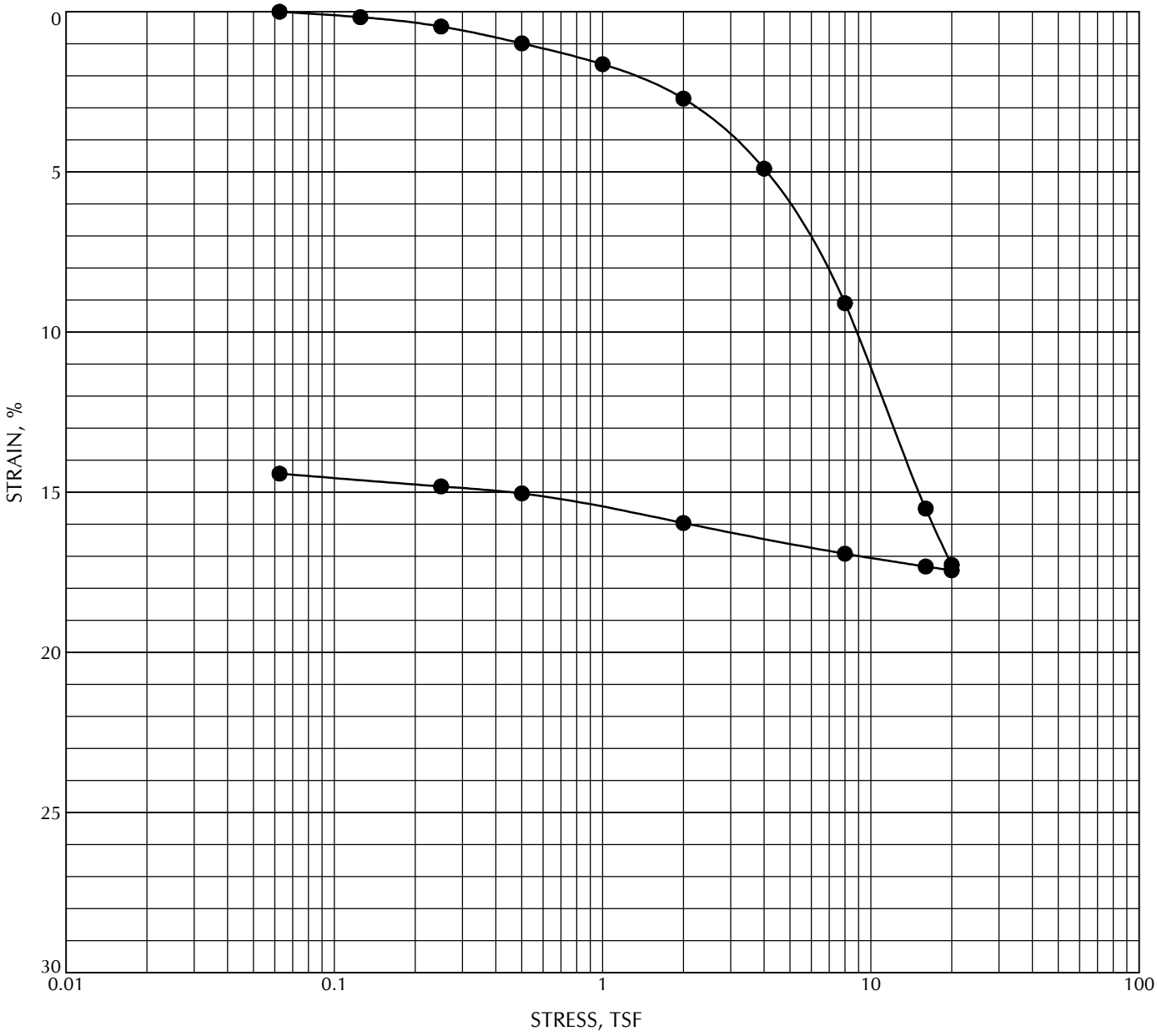
	Location	Sample	Depth, ft	Classification	Initial γ_d, pcf	Initial MC, %
●	B-3	S-2	5.5	Clayey SILT, some fine- to coarse-grained sand, brown mottled rust and yellow (Logan Hill Formation)	86	36

CONSOL STRAIN GRI - 0 TO 30-1PER PAGE GRI DATA TEMPLATE.GDT 11/8/16

GRI

CONSOLIDATION TEST

OCT. 2017 JOB NO. W1204 FIG. 6A



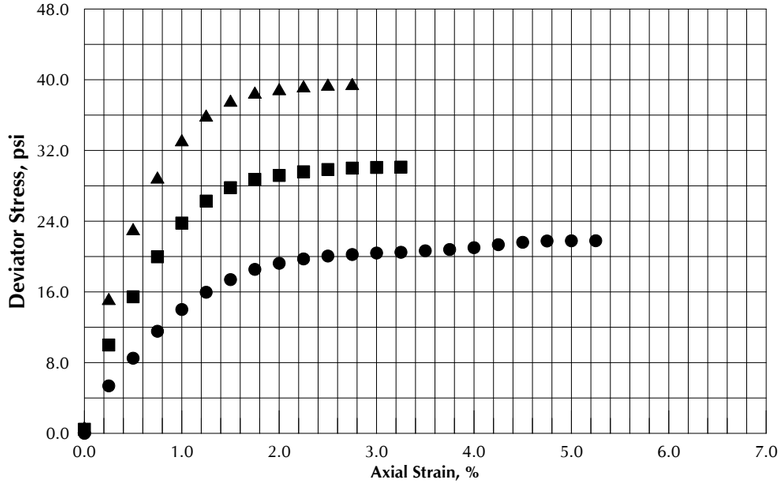
	Location	Sample	Depth, ft	Classification	Initial γ_d, pcf	Initial MC, %
●	B-3	S-5	13.2	Clayey SILT, trace to some gravel, some fine-to coarse-grained sand, brown mottled rust and yellow (Logan Hill Formation)	66	57

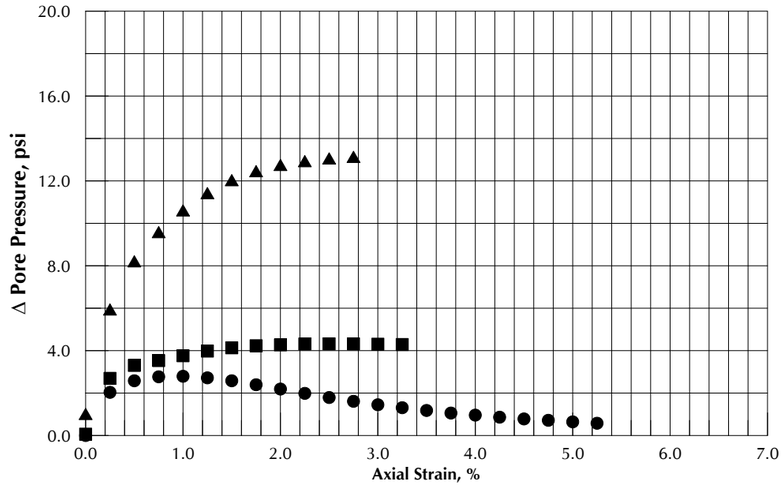
CONSOL STRAIN GRI - 0 TO 30-1PER PAGE GRI DATA TEMPLATE.GDT 11/8/16

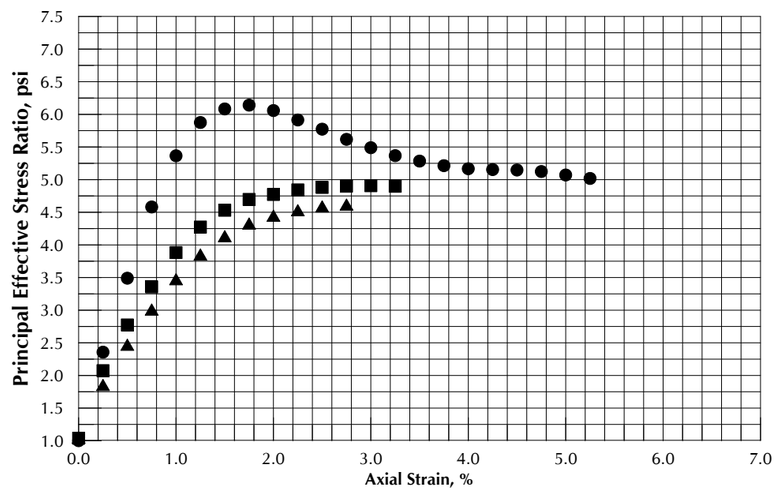
GRI

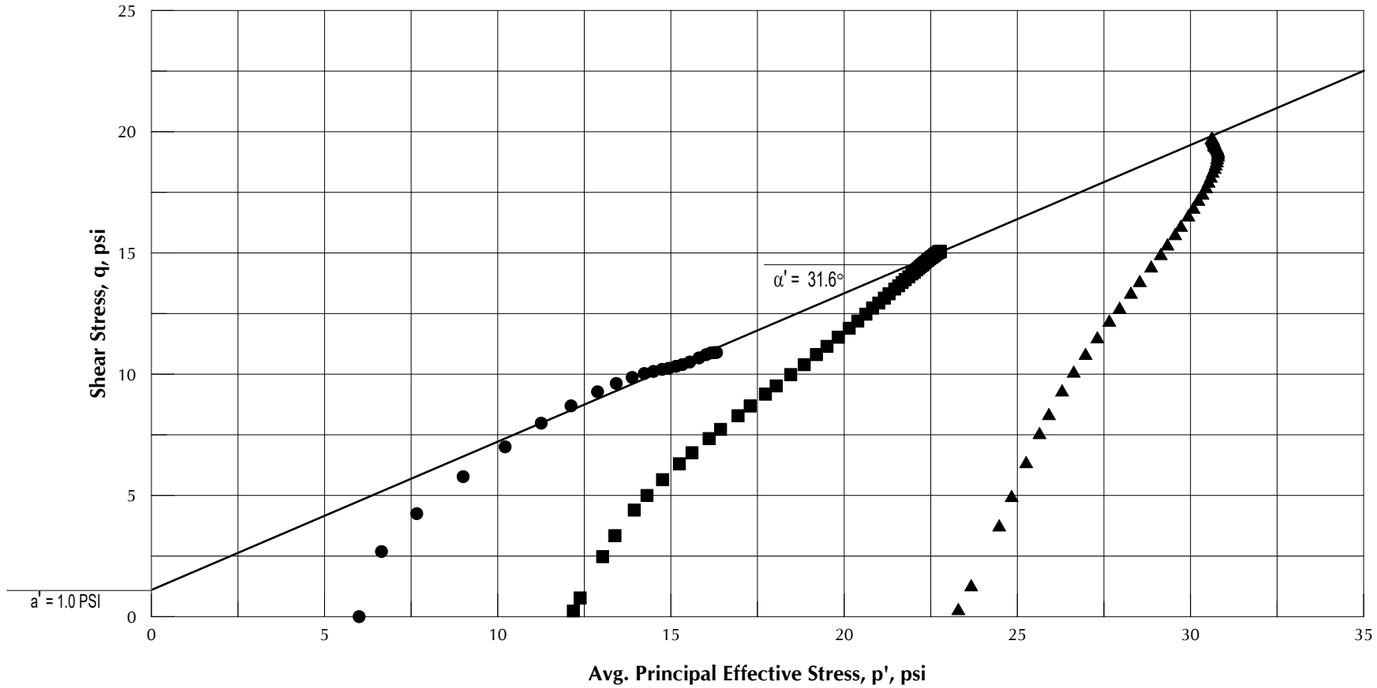
CONSOLIDATION TEST

OCT. 2017 JOB NO. W1204 FIG. 7A









	Stage 1	Stage 2	Stage 3
Test Symbol	●	■	▲
Boring No.	B-3	--	--
Sample No.	S-5	--	--
Depth, ft	13.5	--	--
Effective Confining Pressure, psi	6.00	12.06	24.07
Sample Height, in.	6.00	5.66	5.32
Initial Sample Diameter, in.	2.85	--	--
Dry Unit Wt, pcf	70.1	--	--
W.C.% before test	50.0	--	--
W.C.% after test	--	--	50.0
Strain Rate, %/hr	1	1	1

Soil Classification:
Clayey SILT, trace to some gravel, some fine- to coarse-grained sand, brown mottled rust and yellow

TYPE OF TEST:
■ CU ☐ CD ☐ UU ■ UNDISTURBED ☐ REMOLDED
■ PRESATURATED ■ BACK PRESSURE

FAILURE CRITERIA: MAXIMUM DEVIATOR STRESS

REMARKS: TAN α' = SIN ϕ'
$a' = c' \cos \phi'$ (psi)
$\alpha' = 31.6°$
$\phi' = 38°$
$c' = 1.25$ psi
$a' = 1.0$ psi

GRI

(CU MULTI-STAGE TEST)

TRIAXIAL SHEAR STRENGTH TEST

(BORING B-3, SAMPLE S-5)

OCT. 2017 JOB NO. W1204 FIG. 8A

DEVELOPMENT PERMIT

Lewis County Community Development
2025 NE Kresky Avenue
Chehalis, WA 98532
360-740-1133 – Inspection line
360-740-1146 – Office
360-740-1245 - Fax
www.co.lewis.wa.us – web site

PERMIT NO.:	**G16-00090**
TYPE:	**GRADING**
SUB:	**GRADING**
ISSUED:	**02/27/2017**

Associated Permits: B16-00898

PROJECT DESCRIPTION: **Cut/fill for new water storage reservoir**
Cubic Yards of Fill/Grade: 509 cy fill / 1,907 cy grade

SITE ADDRESS: 1333 S MILITARY RD, CASTLE ROCK

Tax Parcel No: 012546002002
Legal Description: Section 28 Township 11N Range 02W PT SW SW LT 2 Utility Lot Segregation 3412863

APPLICANT: LEWIS COUNTY PUBLIC WORKS DEPT
2025 NE KRESKY AVE
CHEHALIS, WA 98532

OWNER: LEWIS COUNTY
2025 NE KRESKY AVE
CHEHALIS, WA 98532

Acknowledgement:
I certify that I have read and understand the following Conditions of Permit and Requirements for Final Inspection associated with this permit and agree to comply with all conditions.

Signature : ☐ **Owner** ☒ **Applicant** ☐ **Agent** **Date** 2/28/17

CONDITIONS OF PERMIT

1. **All work shall conform to the requirements of the Lewis County Code and any other applicable laws and ordinances.**
2. **Fill material is required to be clean earth material (rock, natural soil or a combination of both)**
3. **All development shall comply with the conditions identified in the attached Lewis County Planning Review dated 1/26/2017.**

NOTICES

PERMIT EXPIRATION: This permit is valid for 180 days (6 months) from the date of issue. Extensions can be granted for a period of 180 days (6 months) with a written request to the Building Official and documentation of the amount of fill/grade completed to that date. Extensions will be granted for the amount of work remaining on the original permit. Additional fill or grade must be approved under separate permit.

PERMIT CHANGE REQUEST: Any change to the permit or the plans associated with this permit after the permit has been issued will be assessed a $50.00 change fee. This fee will be in addition to any fees calculated for the change.

REFUNDS: The Building Official may authorize the refunding of not more than 80% of the base permit fee paid when no work has been done under a permit and upon written request filed by the original permittee not more than 180 days after the date of fee payment. Fees paid for plan reviews, state fees and Critical Areas / Resource Lands (CARL) reviews are non-refundable.

INSPECTIONS: The permit holder must notify the Building Official when construction has commenced to a point that inspection is appropriate. Failure to do so may result in fines and/or penalties being assessed. A minimum **twenty-four (24) hour notice** must be given to assure prompt inspection service. Inspections can be scheduled by calling the inspection line at 360-740-1133.

NOTICE TO CONTRACTORS: For all projects in unincorporated Lewis County, please report sales tax to CODE 2100. Projects in the City limits should be reported to the designated City codes. If you have questions call the Lewis County Treasurer's Office at 360-740-1116 or toll free (within Lewis County) at 1-800-562-6130 ext. 1116.

LEWIS COUNTY
PLANNING REVIEW

Parcel No.: 012546002002

Status: **APPROVED**
Applicant: LEWIS COUNTY PUBLIC WORKS DEPT
Review #: PR16-00830
Application #: SEP16-0040, B16-00898 & G16-00090
Project: 2,416 cy cut/Fill and addition of 250,000 water storage reservoir
Date: 01/26/2017

CONDITIONS OF DEVELOPMENT

Based upon review of the Lewis County Code Titles 15, 16 & 17, the following conditions apply to your project:

1. *Discharge of petroleum or hazardous materials to any ditch, swale, or other non-impervious surfaced area, where migration to an aquifer is reasonably likely, is prohibited.

2. *Buried tanks of any petroleum or hazardous materials shall be prohibited unless the tanks are double-walled and equipped with a leakage monitoring system. Installation of the system shall be certified by the Property Owner or his/her agent. Placement of any buried tanks shall be undertaken only when approval is granted by the Washington State Department of Ecology.

3. *Oil-water separators shall be required for new impervious surface areas of 5,000 square feet or larger.

4. *All development must comply with the requirements of Seismic Risk Zone D-1.

5. *Nothing of a commercial, business, or industrial nature will be constructed, maintained, or suffered to be constructed or maintained on the said land of the grantor(s).

6. *The applicant shall meet the minimum requirements of LCC Chapter 15.45, erosion and sediment control.

7. *The applicant shall obtain all other required local, state and federal permits and approvals.

8. This parcel is located in Flood Zone C, typically areas of minimal flooding. Development in these areas shall be consistent with the Lewis County Flood Damage Prevention Ordinance LCC 15.35.

9. The parcel is located in the City of Vader UGA, however no interlocal UGA Agreement is in place with the City, so all development shall conform to the requirements of the Rural Development District Zoning District, One Residence per 5 acres (RDD-5), per Lewis County Code Title 17.100.

Karen Witherspoon, AICP
Senior Project Planner

Note: * denotes a general requirement

LEWIS COUNTY – STATE ENVIRONMENTAL POLICY ACT
THRESHOLD DETERMINATION
DETERMINATION OF NONSIGNIFICANCE (DNS)

LEAD AGENCY: Lewis County--Community Development Department

PROPONENT: Lewis County – Public Works (Ann Weckback)

FILE NUMBERS: SEP16-0040

DESCRIPTION OF PROPOSAL: Construction of a new 250,000 gallon water reservoir for the Vader Water System, including approximately 2,416 cubic yards of cut/fill as site preparation for the reservoir site

LOCATION OF PROPOSAL: The project is located at the Vader Water Treatment Plant, 1333 S Military Road in Lewis County, Washington on parcel number 012546-002-002 – Section 28, Township 11N, Range 02W, WM.

THRESHOLD DETERMINATION:
The lead agency for this proposal has determined that it does not have a probable, significant adverse impact on the environment. An environmental impact statement (EIS) is NOT required under RCW 43.21C.030(2)(c). This decision was made after review by Lewis County of a completed environmental checklist and other information on file with this agency and such information is adopted herein by reference. This information is available for public review upon request.

This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 14 days from the issue date below. Comments may be submitted during the 14 day period.

Responsible Official: **Lee Napier, Director**
Lewis County Community Development
2025 NE Kresky Avenue
Chehalis, Washington 98532

Contact Person: **Karen A. Witherspoon, AICP, Senior Project Planner**

for Responsible Official

Date of Issue: **January 4, 2017**

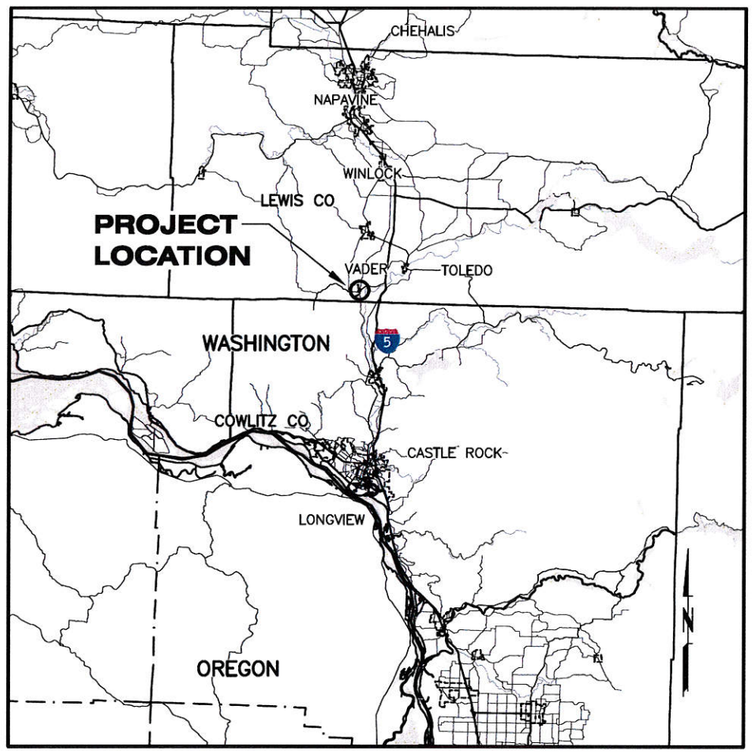
This SEPA determination may be appealed to the Lewis County Hearings Examiner until close of business on January 25, 2017. Appellants should be prepared to make ***specific factual objections****. Details regarding the appeal procedure may be obtained from the Responsible Official.*

Copy

LEWIS COUNTY PUBLIC WORKS
VADER-ENCHANTED VALLEY RESERVOIR

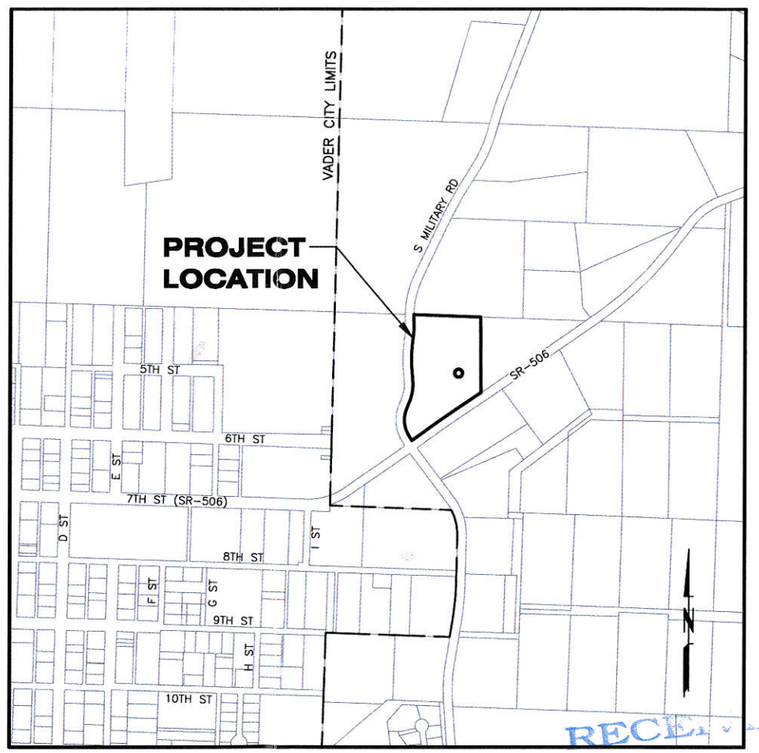
NOVEMBER 2016

PRELIMINARY



VICINITY MAP
SCALE: 1"=2500'

INDEX OF DRAWINGS



LOCATION MAP
SCALE: 1"=500'

MSA Murray, Smith & Associates, Inc.
Engineers/Planners
1145 Broadway Plaza, Suite 1010 PHONE 253.627.1520
Tacoma, Washington 98402-4323 FAX 253.627.1923

811 Know what's below. Call before you dig.

16-1846.202

G-1

GENERAL NOTES

1. ALL MATERIALS AND WORK SHOWN ON THESE PLANS SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS AND CODES, AND ALL OTHER APPLICABLE LOCAL MUNICIPAL, STATE, AND FEDERAL CODES, RULES AND REGULATIONS:
   - CURRENT INTERNATIONAL BUILDING CODE (IBC)
   - 2014 WSDOT/APWA STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION

2. A COPY OF THESE APPROVED PLANS MUST BE ON THE JOBSITE WHENEVER CONSTRUCTION IS IN PROGRESS.

3. DEVIATIONS FROM THESE PLANS MUST BE APPROVED BY THE ENGINEER OF RECORD AND THE LOCAL GOVERNING AUTHORITY.

4. CONTRACTOR SHALL RECORD ALL APPROVED DEVIATIONS FROM THESE PLANS ON A SET OF "AS-BUILT" DRAWINGS AND SHALL SUMMARIZE ALL AS-BUILT CONDITIONS ON ONE SET OF REPRODUCIBLE DRAWING FOR SUBMITTAL TO THE OWNER PRIOR TO PROJECT COMPLETION AND ACCEPTANCE. A SET OF AS-BUILT DRAWINGS SHALL BE SUBMITTED TO THE OWNER PRIOR TO FINAL PROJECT APPROVAL.

5. THE LOCATIONS OF EXISTING UTILITIES AND SITE FEATURES SHOWN HAVE BEEN FURNISHED BY OTHERS BY FIELD SURVEY OR OBTAINED FROM AVAILABLE RECORDS AND SHOULD BE CONSIDERED APPROXIMATE ONLY AND NOT NECESSARILY COMPLETE. IT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO INDEPENDENTLY VERIFY THE ACCURACY OF ALL UTILITY LOCATIONS SHOWN AND TO FURTHER DISCOVER AND PROTECT ANY OTHER UTILITIES NOT SHOWN WHICH MAY BE AFFECTED BY THE IMPLEMENTATION OF THIS PLAN. VERIFY LOCATION, DEPTH, SIZE, TYPE, AND CONDITION OF EXISTING UTILITY LINES AT CONNECTION OR CROSSING POINTS BEFORE TRENCHING FOR NEW UTILITIES. ENGINEER ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS OR ACCURACY OF THE EXISTING UTILITIES AND SITE FEATURES PRESENTED ON THESE DRAWINGS. NOTIFY ENGINEER IMMEDIATELY OF CONFLICTS THAT ARISE.

6. CONTRACTOR SHALL LOCATE AND PROTECT ALL UTILITIES DURING CONSTRUCTION AND SHALL CONTACT THE UNDERGROUND UTILITIES LOCATION SERVICE (1-800-424-5555) AT LEAST TWO BUSINESS DAYS PRIOR TO CONSTRUCTION.

7. CONTRACTOR SHALL VERIFY ALL CONDITIONS AND DIMENSIONS AT THE PROJECT SITE BEFORE STARTING WORK AND SHALL NOTIFY OWNER'S REPRESENTATIVE OF ANY DISCREPANCIES.

8. PIPE LENGTHS, WHERE SHOWN, ARE APPROXIMATE AND MAY CHANGE DUE TO FIELD CONDITIONS.

9. SEGMENTS OF THE WORK MAY BE PERFORMED UNDER HIGH VOLTAGE ELECTRICAL OVERHEAD POWER LINES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PERFORM THE WORK IN A SAFE MANNER AND IN ACCORDANCE WITH ANY REQUIREMENTS SET FORTH BY THE UTILITY OWNER AND APPLICABLE LAWS AND REGULATIONS.

10. RELOCATIONS AND REPLACEMENTS OF EXISTING UTILITIES SHALL BE COORDINATED BY THE CONTRACTOR WITH THE UTILITY OWNER. CONTACT AND SCHEDULE UTILITY SHUT-DOWN TIMES AND DETERMINE THE RELOCATION AND REPLACEMENT REQUIREMENTS OF EXISTING UTILITIES PRIOR TO THE START OF ANY WORK. THE UTILITY SHALL BE RELOCATED OR REPLACED TO THE SATISFACTION OF THE UTILITY OWNER.

11. KEEP ALL CONSTRUCTION ACTIVITIES WITHIN THE PROJECT SITE AS SHOWN. THIS INCLUDES, BUT IS NOT LIMITED TO, VEHICLES AND EQUIPMENT, LIMITS OF TRENCH EXCAVATION, STOCKPILED EXCAVATED MATERIAL, BACKFILL MATERIAL, AND PIPE MATERIAL. IF THE CONTRACTOR REQUIRES ADDITIONAL CONSTRUCTION EASEMENTS, IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN SUCH EASEMENTS FROM INDIVIDUAL PROPERTY OWNERS AND BEAR ALL ASSOCIATED COSTS.

12. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT IMPROVEMENTS FROM DAMAGE AND ALL SUCH IMPROVEMENTS OR STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE RECONSTRUCTED TO THE SATISFACTION OF THE OWNER AT THE EXPENSE OF THE CONTRACTOR.

13. EXCAVATION SHALL MEET THE REQUIREMENTS OF OSHA 29 CFR PART 1926, SUBPART P, EXCAVATIONS. ACTUAL SLOPES SHALL NOT EXCEED THE MAXIMUM ALLOWABLE SLOPES.

14. ANY DISCREPANCIES FOUND BETWEEN THE DRAWINGS AND ACTUAL SITE CONDITIONS, OR ANY INCONSISTENCIES OR AMBIGUITIES BETWEEN THE DRAWINGS AND OTHER COMPONENTS OF THE CONTRACT DOCUMENTS, SHALL BE IMMEDIATELY REPORTED IN WRITING TO THE ENGINEER. THE ENGINEER WILL PROMPTLY CORRECT INCONSISTENCIES OR AMBIGUITIES IN WRITING. WORK DONE BY THE CONTRACTOR AFTER THEIR DISCOVERY OF SUCH DISCREPANCIES WITHOUT A WRITTEN REPORT AND RESPONSE FROM THE ENGINEER SHALL BE DONE AT THE CONTRACTOR'S RISK AND EXPENSE.

15. ALL DIMENSIONS ARE IN STANDARD ENGLISH UNITS.

16. PROTECT EXISTING FACILITIES AND IMPROVEMENTS FROM DAMAGE. USE CARE WHEN EXCAVATING ADJACENT TO EXISTING MANHOLES AND PIPELINES. BRACING MAY BE REQUIRED.

17. SMALL DIAMETER WATER, GAS, AND TELEPHONE CROSSINGS ARE SHOWN AT APPROXIMATE DEPTH. THE ACTUAL DEPTHS OF THE CROSSINGS IS LIKELY TO BE DIFFERENT FROM THAT SHOWN.

18. ALL CALLOUTS AND NOTES ARE DIRECTED TO THE CONTRACTOR UNLESS SPECIFICALLY STATED OTHERWISE.

19. PROTECTION OF THE ENVIRONMENT: NO CONSTRUCTION-RELATED ACTIVITY SHALL CONTRIBUTE TO THE DEGRADATION OF THE ENVIRONMENT, ALLOW MATERIAL TO ENTER SURFACE OR GROUND WATERS, OR ALLOW PARTICULATE EMISSIONS TO THE ATMOSPHERE WHICH EXCEED STATE OR FEDERAL STANDARDS. ANY ACTIONS THAT POTENTIALLY ALLOW A DISCHARGE TO STATE WATERS MUST HAVE PRIOR APPROVAL OF THE STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY.

20. CONSTRUCTION SHALL BE CONDUCTED IN STRICT ACCORDANCE WITH PERMIT RESTRICTIONS AND PUBLIC FACILITY ACCESS RESTRICTIONS.

21. CONTRACTOR SHALL OBTAIN AND THE OWNER SHALL PAY FOR ALL PERMITS REQUIRED FOR INSTALLATION OF ALL IMPROVEMENTS INDICATED ON THESE DRAWINGS.

22. THIS PROJECT IS NOT A BALANCED EARTHWORK PROJECT. BOTH EXPORT AND IMPORT OF SOIL AND ROCK MATERIALS ARE REQUIRED.

23. CONTRACTOR SHALL BE RESPONSIBLE FOR AND SHALL INSTALL AND MAINTAIN SHORING AND BRACING AS NECESSARY TO PROTECT WORKERS, EXISTING BUILDINGS, UTILITIES, AND OTHER EXISTING AND PROPOSED IMPROVEMENTS AND EXCAVATIONS AGAINST LOSS OF GROUND OR CAVING EMBANKMENTS. CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR REMOVAL OF SHORING AND BRACING, AS REQUIRED.

24. THE DAY BEFORE EACH UTILITY CONNECTION, THE CONTRACTOR SHALL EXPOSE AND LOCATE CONNECTION POINTS AND PRE-ASSEMBLE ALL FITTINGS AND VALVES THAT ARE NECESSARY FOR THAT CONNECTION.

25. NEW UTILITY LOCATIONS ARE GENERALLY SHOWN BY DIMENSION. WHERE NO DIMENSIONS ARE INDICATED, LOCATIONS MAY BE SCALED FROM DRAWINGS. FIELD ADJUSTMENTS SHALL BE APPROVED BY OWNER'S REPRESENTATIVE AND CITY.

26. SIGNING, FLAGGING, AND TRAFFIC CONTROL SHALL BE IN ACCORDANCE WITH THESE STANDARDS, THE WSDOT TRAFFIC MANUAL, AND THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES.

27. TEMPORARY EROSION/SEDIMENTATION CONTROL MEASURES MEETING CITY REQUIREMENTS SHALL BE EMPLOYED TO PROTECT ADJACENT PROPERTY AND STORM DRAINAGE FACILITIES.

28. ALL EXCESS OR UNSUITABLE MATERIAL SHALL BE DISPOSED OF PROPERLY OFF-SITE.

29. AS A MINIMUM REQUIREMENT, ALL DISTURBED AREAS ON- AND OFF-SITE SHALL BE RETURNED TO THE EQUIVALENT OF THEIR PRECONSTRUCTION CONDITION IN ACCORDANCE WITH APPROPRIATE REQUIREMENTS AND STANDARDS.

30. KEEP STREETS CLEAN AT ALL TIMES BY SWEEPING. WASHING OF THESE STREETS WILL NOT BE ALLOWED.

SURVEY NOTES

1. INFORMATION DEPICTED HEREIN REPRESENTS THE RESULTS OF SURVEY MADE IN JULY AND AUGUST 2016. MAPPING REPRESENTS THE GENERAL CONDITIONS EXISTING AT THAT TIME.

2. THE CONTRACTOR SHALL FIELD STAKE THE PROPOSED WATER ALIGNMENT FOR ENGINEERS APPROVAL PRIOR TO CONSTRUCTION. REFER TO SECTION 1-05.04 OF THE SPECIAL PROVISIONS.

HORIZONTAL DATUM:

BEARINGS ARE BASED ON NAD 83/91 (WASHINGTON STATE PLANE GRID, SOUTH ZONE). HORIZONTAL CONTROL FOR PROJECT WAS DERIVED FROM STATIC OBSERVATIONS USING WSDOT MONUMENTS GP21005-14 (MON ID 307), GP21005-17 (MON ID 306) AND LEWIS COUNTY STATIC POINT WINVAD FOR BASE CONTROL. ADDITIONAL BASELINES WERE ALSO COLLECTED BY RTK METHOD FOR SECTION CORNER CONTROL.

VERTICAL DATUM:

ELEVATIONS ARE NAVD '88 PER WSDOT MONUMENT ID#4067 (F-535).

CONSTRUCTION SEQUENCING NOTES

1. CONTRACTOR SHALL BE REQUIRED TO SUBMIT A DETAILED CONSTRUCTION SEQUENCING PLAN PER THE REQUIREMENTS OUTLINED BELOW. AS WELL AS SECTION 33 11 13 OF THE TECHNICAL SPECIFICATIONS, SECTION 7-09 OF THE STANDARD SPECIFICATION AND THE SPECIFIC REQUIREMENTS NOTED ON THE PLANS. A SEPARATE SEQUENCING PLAN SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL FOR EACH LENGTH OF WATER LINE THAT WILL BE TESTED SEPARATELY. CONSTRUCTION SHALL NOT BEGIN ON ANY LENGTH OF PIPE UNTIL THE ENGINEER HAS APPROVED IN WRITING THE CONTRACTORS' PROPOSED SEQUENCING PLAN.

2. INSTALL TEMPORARY CONSTRUCTION BLOW-OFF AT ONE END OF THE PIPE FOR TESTING PURPOSES (INCIDENTAL TO OTHER PAY ITEMS). BLOW-OFF SIZE MUST BE SUFFICIENT TO PRODUCE A FLOW VELOCITY OF 2.5 FEET PER SECOND IN WATER MAIN.

3. PRESSURE TEST, FLUSH, DISINFECT, AND BACTERIA TEST PROPOSED WATER LINE AND WATER SERVICES PER SPECIFICATIONS.

4. SEQUENCING PLAN SHALL INCLUDE DETAIL CONNECTIONS TO EXISTING WATER LINES. MAXIMUM SHUTDOWN TIME IS 4 HOURS.

VALVE AND FITTING ASSEMBLIES

1. ALL MECHANICAL JOINT VALVES AND FITTING INSTALLATION SHALL INCLUDE JOINT RESTRAINTS AND MINIMUM ONE FULL LENGTH OF PIPE. RESTRAINED JOINTS SHALL ALSO BE INSTALLED FOR ALL CONNECTIONS TO EXISTING FITTINGS, INCLUDING MECHANICAL JOINT.

2. INSTALL A VALVE MARKER POST AT EACH PROPOSED VALVE LOCATION. WHERE VALVE IS CLOSER THAN 10 FEET FROM ANY ROADWAY, OFFSET MARKER POST 10 FEET PERPENDICULAR TO ROADWAY.

3. STAKE LOCATION OF PROPOSED VALVE AND FITTING CLUSTERS AND OTHER APPURTENANCES FOR APPROVAL BY ENGINEER PRIOR TO CONSTRUCTION.

4. FOR FITTING MINIMUM REQUIRED RESTRAINED LENGTH, REFER TO RESTRAINED LENGTH TABLE, SHEET C-XX.

DESIGN CRITERIA

GENERAL:

DESIGN EQUIVALENT RESIDENTIAL UNITS (ERUs)	<TO FOLLOW>
AVERAGE DAILY DEMAND (ADD)	
MAXIMUM DAILY DEMAND (MDD)	
PEAK DAILY DEMAND (PHD)	

RESERVOIR:

NOMINAL VOLUME	200,000 GAL
FIRE STORAGE	25,500 GAL
DIAMETER	53'-0"
SIDEWALL HEIGHT	20'-0"

PUMP STATION:

TYPE	<TO FOLLOW>
CAPACITY - PUMP 1	
CAPACITY - PUMPS 2 & 3	
CAPACITY - PUMP 1 + PUMP 2/3	
MOTOR HORSEPOWER, HP - PUMP 1	
MOTOR HORSEPOWER, HP - PUMPS 2, 3	

PRELIMINARY

NO.	DATE	BY	REVISION

NOTICE: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

KLT DESIGNED | DKH DRAWN | MGM CHECKED

PRELIMINARY ONLY — NOT FOR CONSTRUCTION — NOVEMBER 2016 — MURRAY, SMITH & ASSOCIATES, INC.

MSA Murray, Smith & Associates, Inc. Engineers/Planners
1145 Broadway Plaza, Suite 1010 Tacoma, Washington 98402-4323 PHONE 253.627.1520 FAX 253.627.1923

LEWIS COUNTY Washington • First County est. 1845

VADER-ENCHANTED VALLEY RESERVOIR

GENERAL NOTES AND DESIGN CRITERIA

PROJECT NO.: 16-1846.202 | SCALE: AS SHOWN | DATE: NOVEMBER 2016

SHEET G-2 X of X

PIPE & FITTING SYMBOLS

PLANT	SCHEMATIC	
		WELDED JOINT
		FLANGED JOINT
		GROOVED END JOINT
		MECHANICAL JOINT
		PUSH-ON JOINT (RUBBER GASKET)
		FLANGED COUPLING ADAPTER
		DOUBLE BALL FLEXIBLE EXTENSION COUPLING
		FLEXIBLE COUPLING W/ THRUST RING
		90° BEND UP
		90° BEND DOWN
		TEE UP
		TEE DOWN
		LATERAL UP
		LATERAL DOWN
		CONCENTRIC REDUCER
		ECCENTRIC REDUCER
		UNION
		BLIND FLANGE
		CAP
		LONG SLEEVE
		FLEXIBLE COUPLING
		FITTING (45°)

VALVE SYMBOLS

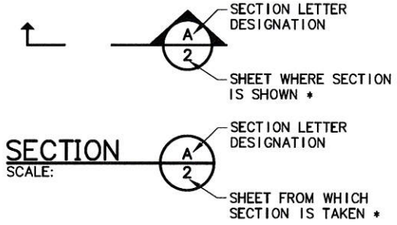
PLANT	SCHEMATIC	
		BUTTERFLY VALVE
		GATE VALVE
		GLOBE VALVE
		BALL VALVE
		BALANCING VALVE
		PLUG VALVE (TOP)
		PLUG VALVE (SIDE)
		3-WAY PLUG VALVE
		CHECK VALVE
		SWING CHECK VALVE
		DOUBLE CHECK ASSEMBLY
		BALL SWING CHECK
		SILENT CHECK VALVE
		PRESSURE REDUCING VALVE
		ALTITUDE CONTROL VALVE
		SOLENOID VALVE
		RELIEF VALVE
		NEEDLE VALVE
		HOSE VALVE
		REDUCED PRESSURE BACKFLOW PREVENTER W/ GATE VALVES
		HOSE BIBB

TOPOGRAPHIC LEGEND

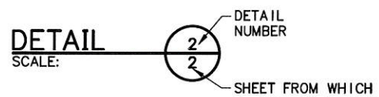
	EXISTING	PROPOSED
WATERLINE	----10"W----	12"DI W
ELECTRICITY	-----E-----	E
GAS	----4"G----	
TELEPHONE/TELEMETRY	-----T-----	
CABLE TELEVISION	----CATV----	
SANITARY SEWER LINE	----8"SS----	
SANITARY SEWER FORCE MAIN	----6"FM----	
STORM DRAIN	----8"SD----	8"SD
CULVERT		18"D
ABANDON PIPE		
DRAINAGE DITCH		
BARBWIRE FENCE	x x x	x x x
CHAIN LINK FENCE		
TEMPORARY SILT FENCE		
GUARDRAIL		
TREE/BUSH LINE		
CENTERLINE		
EASEMENT/PROPERTY LINE		
RIGHT-OF-WAY		
EDGE OF PAVEMENT/AC		
EDGE OF GRAVEL		
CURB		
SIDEWALK	S/W	
STRUCTURE OR FACILITY		
CONTOUR MINOR		
CONTOUR MAJOR	200	200
MANHOLE		
CLEAN-OUT		
CATCH BASIN/FIELD INLET		
THRUST BLOCK		
VALVE		
AIR INJECTION ASSEMBLY		
BLOW-OFF ASSEMBLY		
AIR RELEASE ASSEMBLY		
FIRE HYDRANT ASSEMBLY		
WATER METER		
PULL BOX/JUNCTION BOX		
UTILITY POLE		
GUY WIRE		
LIGHT POST		
MAILBOX		
SIGN		
BENCHMARK		
BORING	B-X	
TREE DECIDUOUS		
TREE CONIFEROUS		
TREE TO BE REMOVED		
SURFACE ELEVATION	+ 100.00	

SECTION AND DETAIL DESIGNATIONS

SECTION DESIGNATIONS



DETAIL DESIGNATIONS



* NOTE: IF PLAN AND SECTION FOR DETAIL CALL-OUT AND DETAIL ARE SHOWN ON THE SAME DRAWING, DRAWING NUMBER IS REPLACED WITH A DASH.

MISCELLANEOUS PIPING SYMBOLS

	STRAINER
	SIGHT GLASS
	PRESSURE GAUGE W/ COCK
	PRESSURE SWITCH W/ COCK
M	METER
SP	SLIP-ON JOINT PIPE
R	RESTRAINED JOINT PIPE

PRELIMINARY

NO.	DATE	BY	REVISION

NOTICE: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

KLT DESIGNED | DKH DRAWN | MGM CHECKED

PRELIMINARY ONLY — NOT APPROVED FOR CONSTRUCTION — NOVEMBER 2016 — MURRAY, SMITH & ASSOCIATES, INC.

MSA Murray, Smith & Associates, Inc. Engineers/Planners
1145 Broadway Plaza, Suite 1010 PHONE 253.627.1520
Tacoma, Washington 98402-4323 FAX 253.627.1923

LEWIS COUNTY — Washington's First County — est. 1845

VADER-ENCHANTED VALLEY RESERVOIR

SYMBOLS AND LEGEND

SHEET G-3 (X of X)

PROJECT NO.: 16-1846.202 | SCALE: AS SHOWN | DATE: NOVEMBER 2016

@	AT
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS
AB	ANCHOR BOLT
ABAN(D)	ABANDON(ED)
ABS	ACRYLONITRILE BUTADIENE STYRENE
ABV	ABOVE
AC	ASPHALTIC CONCRETE
ACP	ASPHALTIC CONCRETE PAVING
ADJ	ADJUSTABLE
ADJC	ADJACENT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHR	ANCHOR
AL	ALUMINUM
ALT	ALTERNATE
AMP	AMPERE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATE
APPVD	APPROVED
APWA	AMERICAN PUBLIC WORKS ASSOCIATION
ARCH	ARCHITECTURAL
ARV	AIR RELEASE VALVE
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASSN	ASSOCIATION
ASSY	ASSEMBLY
ASTM	AMERICAN SOCIETY FOR TESTING & MATERIALS
ATM	ATMOSPHERE
AUTO	AUTOMATIC
AUX	AUXILIARY
AVE	AVENUE
AVG	AVERAGE
AWWA	AMERICAN WATER WORKS ASSOCIATION
B&S	BELL & SPIGOT
BC	BOLT CIRCLE
BD	BOARD
BETW	BETWEEN
BF	BOTH FACE
BFD	BACKFLOW PREVENTION DEVICE
BFILL	BACKFILL
BFV	BUTTERFLY VALVE
BHP	BRAKE HORSEPOWER
BLGD	BACKGROUND
BLDG	BUILDING
BLK	BLOCK
BLVD	BOULEVARD
BM	BENCHMARK / BEAM
BMP	BEST MANAGEMENT PRACTICES
BO	BLOWOFF
BOC	BACK OF CURB
BS	BOTH SIDES
BSMT	BASEMENT
BTF	BOTTOM FACE
BTU	BRITISH THERMAL UNIT
BV	BALL VALVE
BW	BOTH WAYS
C	CELSIUS
C TO C	CENTER TO CENTER
CARV	COMBINATION AIR RELEASE VALVE
CATV	CABLE TELEVISION
CB	CATCH BASIN
CCP	CONCRETE CYLINDER PIPE
CCW	COUNTER CLOCKWISE
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CHAN	CHANNEL
CHEM	CHEMICAL
CHFR	CHAMFER
CHKV	CHECK VALVE
CI	CAST IRON
CIP	CAST IRON PIPE
CIPC	CAST IN PLACE CONCRETE
CISP	CAST IRON SOIL PIPE
CJ	CONSTRUCTION JOINT
CL OR ℄	CENTER LINE
CL2	CHLORINE
CLG	CEILING
CLJ	CONTROL JOINT
CLR	CLEAR
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CND	CONDUIT
CO	CLEANOUT
COL	COLUMN
COMB	COMBINATION
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS / CONTINUATION
CONTR	CONTRACT(OR)
COORD	COORDINATE
COP	COPPER
CORP	CORPORATION
CORR	CORRUGATED
CP	CONTROL POINT
CPLG	COUPLING
CPVC	CHLORINATED POLYVINYL CHLORIDE
CR	CRUSHED ROCK
CS	COMBINED SEWER
CSP	CONCRETE SEWER PIPE
CT	COURT
CTR	CENTER
CU	CUBIC
CULV	CULVERT
CV	CONTROL VALVE
CW	CLOCKWISE / COLD WATER
CY	CUBIC YARDS
CYL	CYLINDER LOCK
D	DRAIN
DC	DIRECT CURRENT
DEFL	DEFLECTION
DET	DETAIL
DI	DUCTILE IRON
DIA	DIAMETER
DIM	DIMENSION
DIR	DIRECTION
DIST	DISTANCE
DN	DOWN
DR	DRIVE
DS	DOWNSPOUT
DWG	DRAWING
DWL	DOWEL
DWV	DRAIN WASTE AND VENT
DWY	DRIVEWAY
EA	EACH
ECC	ECCENTRIC
EF	EACH FACE
EL	ELEVATION
ELB	ELBOW
ELEC	ELECTRICAL
ENCL	ENCLOSURE
EOP	EDGE OF PAVEMENT
EQ	EQUAL
EQL SP	EQUALLY SPACED
EQUIP	EQUIPMENT
EW	EACH WAY
EXC	EXCAVATE
EXIST	EXISTING
EXP	EXPANSION
EXP BT	EXPANSION BOLT
EXP JT	EXPANSION JOINT
EXT	EXTERIOR
F	FAHRENHEIT
F TO F	FACE TO FACE
FAB	FABRICATE
FB	FLAT BAR
FCA	FLANGED COUPLING ADAPTER
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FDN	FOUNDATION
FEXT	FIRE EXTINGUISHER
FF	FAR FACE
FGL	FIBERGLASS
FH	FIRE HYDRANT
FIN	FINISH(ED)
FIPT	FEMALE IRON PIPE THREAD
FITP	FITTING
FL	FLOOR LINE
FLEX	FLEXIBLE
FLG	FLANGE
FLL	FLOW LINE
FLR	FLOOR
FM	FORCE MAIN
FO	FIBER OPTIC
FOC	FACE OF CONCRETE
FOF	FACE OF FINISH
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FRP	FIBERGLASS REINFORCED PLASTIC
FT	FEET / FOOT
FTG	FOOTING
FUT	FUTURE
FW	FINISH WATER
G	GAS
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GC	GROOVED COUPLING
GFA	GROOVED FLANGE ADAPTER
GI	GALVANIZED IRON
GIP	GALVANIZED IRON PIPE
GJ	GRIP JOINT
GL	GLASS
GLV	GLOBE VALVE
GND	GROUND
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GPS	GALLONS PER SECOND
GR	GRADE
GR LN	GRADE LINE
GRTG	GRATING
GV	GATE VALVE
GRVL	GRAVEL
GYP	GYPSUM
HB	HOSE BIBB
HC	HOLLOW CORE
HDPE	HIGH DENSITY POLYETHYLENE
HDR	HEADER
HDWE	HARDWARE
HGR	HANGER
HGT	HEIGHT
HH	HANDHOLD
HM	HOLLOW METAL
HNDRL	HAND RAIL
HOA	HAND-OFF-AUTO
HOR	HAND-OFF-REMOTE
HORIZ	HORIZONTAL
HP	HIGH PRESSURE / HORSEPOWER
HPG	HIGH PRESSURE GAS
HPT	HIGH POINT
HR	HOUR
HSB	HIGH STRENGTH BOLT
HV	HOSE VALVE
HVAC	HEATING, VENTILATION, AIR CONDITIONING
HWL	HIGH WATER LINE
HWY	HIGHWAY
HYD	HYDRANT
HYDR	HYDRAULIC
I&C	INSTRUMENTATION & CONTROL
IAW	IN ACCORDANCE WITH
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IF	INSIDE FACE
IMPVT	IMPROVEMENT
IN	INCH
INCC	INCLUDE(D)(ING)
INFL	INFLUENT
INJ	INJECTION
INSTL	INSTALLATION / INSTALL
INSUL	INSULATION
INTER	INTERCEPTOR
INTR	INTERIOR
INV	INVERT
IP	IRON PIPE
IPT	IRON PIPE THREAD
IR	IRON ROD
IRRIG	IRRIGATION
JT	JOINT
JUNC	JUNCTION
KPL	KICK PLATE
KVA	KILOVOLT AMPERE
KW	KILOWATT
KWY	KEYWAY
L	LENGTH
LAB	LABORATORY
LAV	LAVATORY
LB	POUND
LF	LINEAR FOOT
LIN	LINEAL
LN	LANE
LOC	LOCATION
LONG	LONGITUDINAL
LP	LOW PRESSURE
LPT	LOW POINT
LRG	LARGE
LS	LONG SLEEVE / LUMP SUM
LT	LEFT
LVL	LEVEL
LWL	LOW WATER LINE
MAN	MANUAL
MAT	MATERIAL
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MCP	MASTER CONTROL PANEL
MECH	MECHANICAL
MET	METAL
MFR	MANUFACTURER
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MIN	MINIMUM
MIPT	MALE IRON PIPE THREAD
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MON	MONUMENT / MONOLITHIC
MOT	MOTOR
MP	MILEPOST
MSL	MEAN SEAL LEVEL
MTD	MOUNTED
NA	NOT APPLICABLE
NC	NORMALLY CLOSED
NF	NEAR FACE
NIC	NOT IN CONTRACT
NO / NO.	NORMALLY OPEN / NUMBER
NOM	NOMINAL
NORM	NORMAL
NRS	NON-RISING STEM
NTS	NOT TO SCALE
O TO O	OUT TO OUT
OC	ON CENTER
OD	OUTSIDE DIAMETER
ODOT	OREGON DEPARTMENT OF TRANSPORTATION
OF	OVERFLOW / OUTSIDE FACE
OPNG	OPENING
OPP	OPPOSITE
ORIG	ORIGINAL
OVHD	OVERHEAD
P&ID	PROCESS & INSTRUMENTATION DIAGRAM
PC	POINT OF CURVE
PCC	POINT OF COMPOUND CURVE
PCVC	POINT OF CURVATURE ON VERTICAL CURVE
PE	PLAIN END
PERF	PERFORATED
PERM	PERMANENT
PERP	PERPENDICULAR
PG	PRESSURE GAUGE
PH	PIPE HANGER
PI	POINT OF INTERSECTION
PIVC	POINT OF INTERSECTION ON VERTICAL CURVE
PL OR ℄	PROPERTY LINE / PLATE / PLASTIC
PLBG	PLUMBING
PNL	PANEL
POC	POINT OF CURVATURE
POLY	POLYETHYLENE
POT	POINT OF TANGENCY
PP	POWER POLE
PRC	POINT OF REVERSE CURVATURE
PRCST	PRECAST
PREP	PREPARATION
PRESS	PRESSURE
PRKG	PARKING
PROP	PROPERTY
PRV	PRESSURE REDUCING VALVE
PS	PUMP STATION
PSIG	POUNDS PER SQUARE INCH GAGE
PSL	PIPE SLEEVE
PSPT	PIPE SUPPORT
PT	POINT OF TANGENCY
PTVC	POINT OF TANGENCY ON VERTICAL CURVE
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PWR	POWER
QTY	QUANTITY
RAD	RADIUS
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD / ROOF DRAIN
RDCR	REDUCER
REF	REFERENCE
REINF	REINFORCE(D)(ING)(MENT)
REQ'D	REQUIRED
RESTR	RESTRAINED
RFCA	RESTRAINED FLANGE COUPLING ADAPTER
RM	ROOM
RND	ROUND
RO	ROUGH OPENING
R/W	RIGHT-OF-WAY
RPBPD	REDUCED PRESSURE BACKFLOW PREVENTION DEVICE
RPM	REVOLUTIONS PER MINUTE
RR	RAILROAD
RST	REINFORCED STEEL
RT	RIGHT
RW	RAW WATER
SALV	SALVAGE
SAN	SANITARY
SC	SOLID CORE
SCHED	SCHEDULE
SD	STORM DRAIN
SDL	SADDLE
SDR	STANDARD DIMENSION RATIO
SECT	SECTION
SHLDR	SHOULDER
SHT	SHEET
SIM	SIMILAR
SLP	SLOPE
SLV	SLEEVE
SOLN	SOLUTION
SP	SOIL PIPE / SEWER PIPE
SPCL	SPECIAL
SPEC(S)	SPECIFICATION(S)
SPG	SPACING
SPL	SPOOL
SPRT	SUPPORT
SQ	SQUARE
SQ FT	SQUARE FOOT
SQ IN	SQUARE INCH
SQ YD	SQUARE YARD
SS	SANITARY SEWER
SST	STAINLESS STEEL
ST	STREET
STA	STATION
STD	STANDARD
STL	STEEL
STOR	STORAGE
STR	STRAIGHT
STRUCT	STRUCTURE / STRUCTURAL
SUBMG	SUBMERGED
SUCT	SUCTION
SV	SOLENOID VALVE
S/W	SIDEWALK
SWD	SIDEWATER DEPTH
SWGR	SWITCH GEAR
SYMM	SYMMETRICAL
SYS	SYSTEM
T OR TEL	TELEPHONE
T&B	TOP & BOTTOM
TAN	TANGENCY
TB	THRUST BLOCK
TBM	TEMPORARY BENCH MARK
TC	TOP OF CONCRETE / TOP OF CURB
TDH	TOTAL DYNAMIC HEAD
TEMP	TEMPERATURE / TEMPORARY
T&G	TONGUE & GROOVE
THK	THICKNESS
THRD	THREAD (ED)
THRU	THROUGH
TP	TEST PIT / TOP OF PAVEMENT / TURNING POINT
TRANS	TRANSITION
TSP	TRI-SODIUM PHOSPHATE
TST	TOP OF STEEL
TW	TOP OF WALL
TYP	TYPICAL
UG	UNDERGROUND
UH	UNIT HEATER
UN	UNION
UON	UNLESS OTHERWISE NOTED
USGS	UNITED STATES GEOLOGIC SURVEY
V	VENT / VOLT
VAC	VACUUM
VB	VACUUM BREAKER
VBOX	VALVE BOX
VC	VERTICAL CURVE
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VOL	VOLUME
VCP	VITRIFIED CLAY PIPE
VTR	VENT THROUGH ROOF
W	WATER
W/	WITH
W/O	WITHOUT
W/W	WALL TO WALL
WD	WOOD
WF	WIDE FLANGE
WH	WATER HEATER
WI	WROUGHT IRON
WM	WATER METER
WP	WORKING POINT / WATERPROOFING
WS	WATER SERVICE
WSDOT	WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
WT	WEIGHT
WTP	WATER TREATMENT PLANT
WTRT	WATERTIGHT
WWF	WELDED WIRE FABRIC
WWTF	WASTEWATER TREATMENT FACILITY
WWTP	WASTEWATER TREATMENT PLANT
X SECT	CROSS SECTION
XFMR	TRANSFORMER
YD	YARD DRAIN / YARD
YH	YARD HYDRANT
YR	YEAR
ZN	ZINC

PRELIMINARY

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

KLT DESIGNED
DKH DRAWN
MGM CHECKED

PRELIMINARY ONLY — NOT FOR CONSTRUCTION — NOVEMBER 2016 — MURRAY, SMITH & ASSOCIATES, INC.

MSA Murray, Smith & Associates, Inc.
Engineers/Planners
1145 Broadway Plaza, Suite 1010 Tacoma, Washington 98402-4323 PHONE 253.627.1520 FAX 253.627.1923

LEWIS COUNTY

VADER-ENCHANTED VALLEY RESERVOIR

ABBREVIATIONS

PROJECT NO.: 16-1846.202 | SCALE: AS SHOWN | DATE: NOVEMBER 2016

SHEET G-4 X of X

STANDARD EROSION CONTROL NOTES:

1. CONTRACTOR SHALL INSTALL AND MAINTAIN EROSION / SEDIMENTATION CONTROL DURING CONSTRUCTION (ANY TIME OF YEAR). EROSION CONTROL SHALL CONFORM TO THE REQUIREMENTS OF THE STORMWATER MANAGEMENT MANUAL OF WESTERN WASHINGTON, VOLUME II – CONSTRUCTION STORMWATER POLLUTION PREVENTION.

2. THE IMPLEMENTATION OF THIS EROSION, SEDIMENT AND POLLUTION CONTROL PLAN AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE FACILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETED AND APPROVED AND VEGETATION / LANDSCAPING IS ESTABLISHED.

3. THE BOUNDARIES OF CLEARING LIMITS SHALL BE CLEARLY FLAGGED IN THE FIELD PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED CLEARING LIMITS SHALL BE PERMITTED. THE FLAGGING SHALL BE MAINTAINED BY THE CONTRACTOR FOR THE DURATION OF CONSTRUCTION.

4. THE EROSION, SEDIMENT AND POLLUTION CONTROL PLAN FACILITIES SHOWN HEREIN MUST BE CONSTRUCTED IN CONJUNCTION WITH ALL CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO ENSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DO NOT ENTER THE DRAINAGE SYSTEM, WATERWAYS, ROADWAYS, OR VIOLATE APPLICABLE WATER STANDARDS.

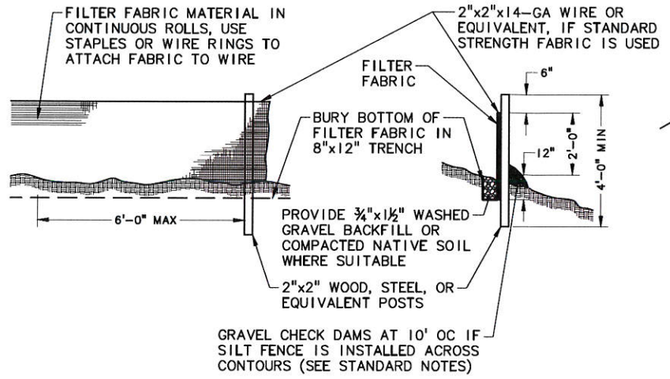
5. THE EROSION, SEDIMENT AND POLLUTION CONTROL PLAN FACILITIES SHOWN HEREIN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THE EROSION, SEDIMENT AND POLLUTION CONTROL FACILITIES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DO NOT LEAVE THE SITE.

6. THE EROSION, SEDIMENT AND POLLUTION CONTROL PLAN FACILITIES SHALL BE INSPECTED DAILY BY THE CONTRACTOR AND MAINTAINED AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTIONING.

7. THE EROSION, SEDIMENT AND POLLUTION CONTROL PLAN FACILITIES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH OR WITHIN 24 HOURS FOLLOWING A STORM EVENT.

8. STABILIZED CONSTRUCTION ENTRANCES AND SEDIMENT FENCES SHALL BE INSTALLED AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES MAY BE REQUIRED TO ENSURE THAT ALL PAVED AREAS ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT.

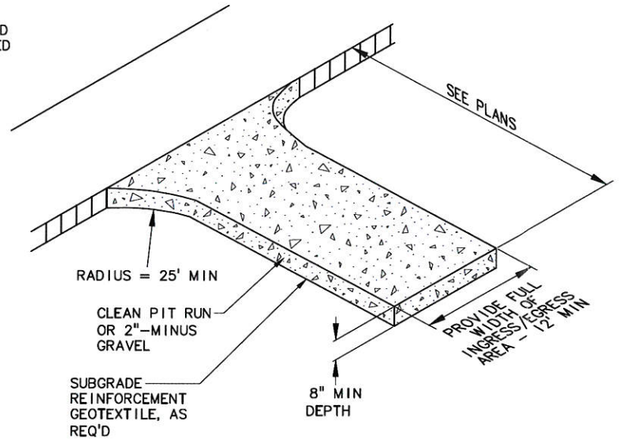
9. EROSION, SEDIMENT AND POLLUTION CONTROL PLAN MEASURES SHALL BE REMOVED BY THE CONTRACTOR UPON SUBSTANTIAL COMPLETION.



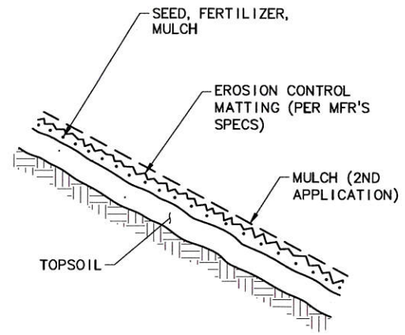
NOTE:

1. POSTS MUST BE SET 18" DEEP FOR SLOPES UNDER 3:1 AND 24" DEEP FOR SLOPES 3:1 AND GREATER.

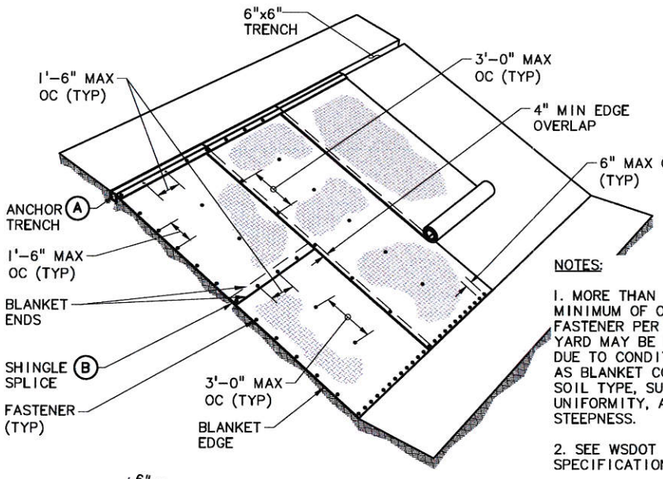
SILT FENCE (1)
SCALE: NTS



GRAVEL CONSTRUCTION ENTRANCE (2)
SCALE: NTS



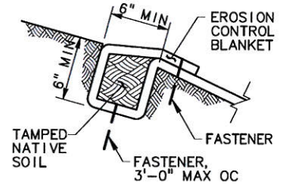
EROSION CONTROL (JUTE) MATTING INSTALLATION (3)
SCALE: NTS



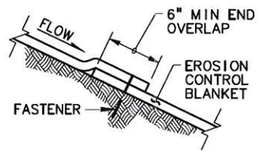
NOTES:

1. MORE THAN THE MINIMUM OF ONE FASTENER PER SQUARE YARD MAY BE REQUIRED DUE TO CONDITIONS SUCH AS BLANKET COMPOSITION, SOIL TYPE, SURFACE UNIFORMITY, AND SLOPE STEEPNESS.

2. SEE WSDOT STANDARD SPECIFICATION 8-01.3(3).

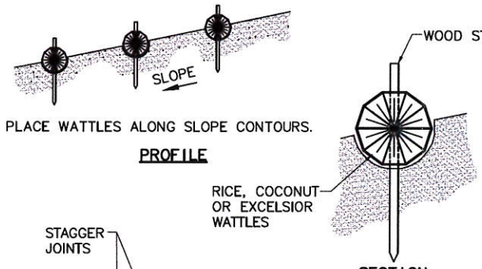


ANCHOR TRENCH SECTION (A)



SHINGLE SPLICE SECTION (B)

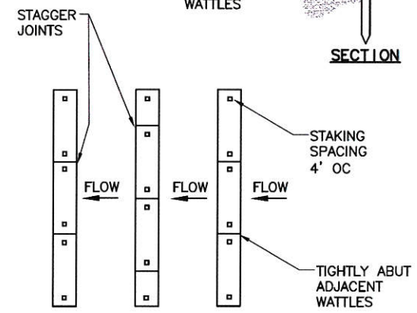
EROSION CONTROL BLANKET PLACEMENT ON SLOPE (5)
SCALE: NTS



PLACE WATTLES ALONG SLOPE CONTOURS.

PROFILE

SECTION

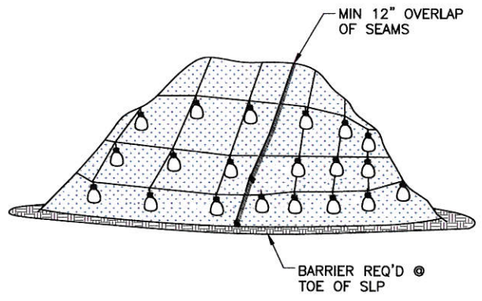


PLAN VIEW

NOTES:

1. STAKING SPECIFICATIONS:
   A. 1"x2" WOODEN STAKED.
   B. ADDITIONAL STAKES MAY BE INSTALLED ON DOWNHILL SIDE OF WATTLES, ON STEEP SLOPE OR HIGHLY EROSIVE SOILS.
2. SPACE WATTLES EVERY 25 FEET ALONG THE SLOPE.

WATTLES (6)
SCALE: NTS

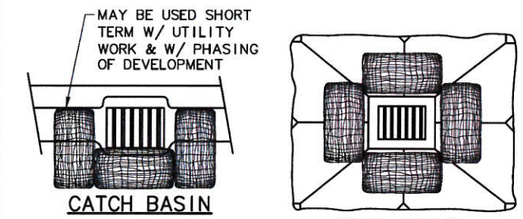


PLASTIC SHEETING

NOTES:

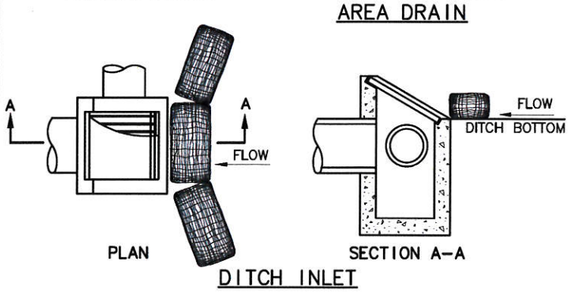
1. MINIMUM 12" OVERLAP OF ALL SEAMS REQUIRED.
2. BARRIER REQUIRED AT TOE OF STOCK PILE.
3. COVERING MAINTAINED TIGHTLY IN PLACE BY USING SANDBAGS OR TIRES ON ROPES WITH A MAXIMUM 10' GRID SPACING IN ALL DIRECTIONS.

PLASTIC SHEETING (7)
SCALE: NTS



CATCH BASIN

AREA DRAIN



PLAN

SECTION A-A

DITCH INLET

INLET PROTECTION – BIOBAGS (4)
SCALE: NTS

RECEIVED
DEC 07 2016

PRELIMINARY

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

KLT DESIGNED
DKH DRAWN
MGM CHECKED

PRELIMINARY ONLY — NOT FOR CONSTRUCTION — NOVEMBER 2016 — MURRAY, SMITH & ASSOCIATES, INC.

MSA Murray, Smith & Associates, Inc. Engineers/Planners
1145 Broadway Plaza, Suite 1010 PHONE 253.627.1520
Tacoma, Washington 98402-4323 FAX 253.627.1923

LEWIS COUNTY

VADER-ENCHANTED VALLEY RESERVOIR

EROSION CONTROL NOTES AND DETAILS

PROJECT NO.: 16-1846.202 | SCALE: AS SHOWN | DATE: NOVEMBER 2016

SHEET C-1 X of X

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PRE-CONSTRUCTION CLEARING NOTES:

1. ALL BASE ESC MEASURES (INLET PROTECTION, PERIMETER SEDIMENT CONTROL, GRAVEL CONSTRUCTION ENTRANCES, ETC.) MUST BE IN PLACE, FUNCTIONAL, AND APPROVED IN AN INITIAL INSPECTION, PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.

2. SEDIMENT BARRIERS APPROVED FOR USE INCLUDE SEDIMENT FENCE, BERMS CONSTRUCTED OUT OF MULCH, CHIPPINGS, OR OTHER SUITABLE MATERIAL, STRAW WATTLES, OR OTHER APPROVED MATERIALS.

3. SENSITIVE RESOURCES INCLUDING, BUT NOT LIMITED TO, TREES, WETLANDS, AND RIPARIAN PROTECTION AREAS SHALL BE CLEARLY DELINEATED WITH ORANGE CONSTRUCTION FENCING OR CHAIN LINK FENCING IN A MANNER THAT IS CLEARLY VISIBLE TO ANYONE IN THE AREA. NO ACTIVITIES ARE PERMITTED TO OCCUR BEYOND THE CONSTRUCTION BARRIER.

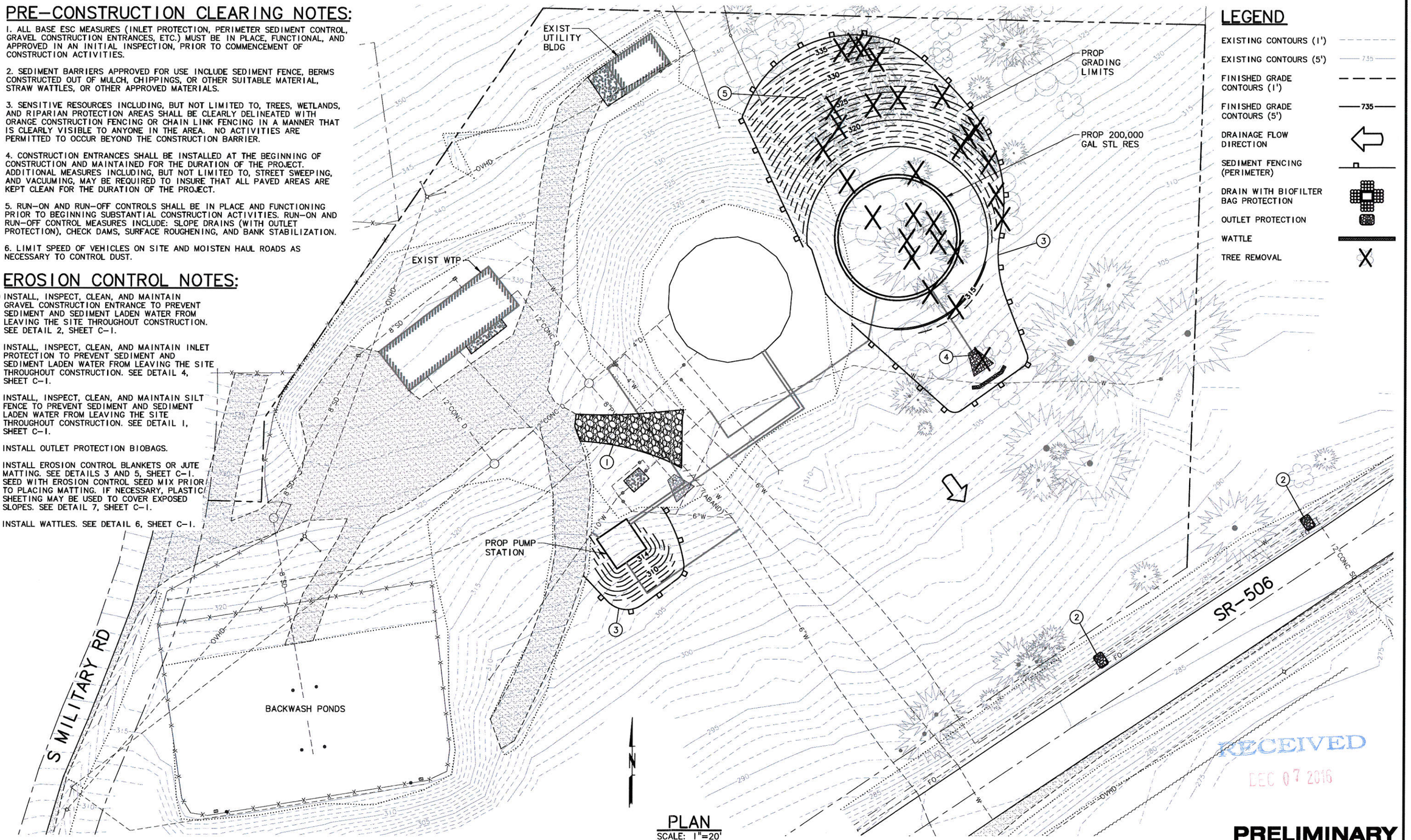
4. CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES INCLUDING, BUT NOT LIMITED TO, STREET SWEEPING, AND VACUUMING, MAY BE REQUIRED TO INSURE THAT ALL PAVED AREAS ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT.

5. RUN-ON AND RUN-OFF CONTROLS SHALL BE IN PLACE AND FUNCTIONING PRIOR TO BEGINNING SUBSTANTIAL CONSTRUCTION ACTIVITIES. RUN-ON AND RUN-OFF CONTROL MEASURES INCLUDE: SLOPE DRAINS (WITH OUTLET PROTECTION), CHECK DAMS, SURFACE ROUGHENING, AND BANK STABILIZATION.

6. LIMIT SPEED OF VEHICLES ON SITE AND MOISTEN HAUL ROADS AS NECESSARY TO CONTROL DUST.

EROSION CONTROL NOTES:

1. INSTALL, INSPECT, CLEAN, AND MAINTAIN GRAVEL CONSTRUCTION ENTRANCE TO PREVENT SEDIMENT AND SEDIMENT LADEN WATER FROM LEAVING THE SITE THROUGHOUT CONSTRUCTION. SEE DETAIL 2, SHEET C-1.
2. INSTALL, INSPECT, CLEAN, AND MAINTAIN INLET PROTECTION TO PREVENT SEDIMENT AND SEDIMENT LADEN WATER FROM LEAVING THE SITE THROUGHOUT CONSTRUCTION. SEE DETAIL 4, SHEET C-1.
3. INSTALL, INSPECT, CLEAN, AND MAINTAIN SILT FENCE TO PREVENT SEDIMENT AND SEDIMENT LADEN WATER FROM LEAVING THE SITE THROUGHOUT CONSTRUCTION. SEE DETAIL 1, SHEET C-1.
4. INSTALL OUTLET PROTECTION BIOBAGS.
5. INSTALL EROSION CONTROL BLANKETS OR JUTE MATTING. SEE DETAILS 3 AND 5, SHEET C-1. SEED WITH EROSION CONTROL SEED MIX PRIOR TO PLACING MATTING. IF NECESSARY, PLASTIC SHEETING MAY BE USED TO COVER EXPOSED SLOPES. SEE DETAIL 7, SHEET C-1.
6. INSTALL WATTLES. SEE DETAIL 6, SHEET C-1.



PLAN
SCALE: 1"=20'

LEGEND

- EXISTING CONTOURS (1')
- EXISTING CONTOURS (5') — 735
- FINISHED GRADE CONTOURS (1')
- FINISHED GRADE CONTOURS (5') — 735
- DRAINAGE FLOW DIRECTION
- SEDIMENT FENCING (PERIMETER)
- DRAIN WITH BIOFILTER BAG PROTECTION
- OUTLET PROTECTION
- WATTLE
- TREE REMOVAL

PRELIMINARY

NO.	DATE	BY	REVISION

NOTICE
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MGM CHECKED

PRELIMINARY ONLY
NOVEMBER 2016

MSA
Murray, Smith & Associates, Inc.
Engineers/Planners
1145 Broadway Plaza, Suite 1010 PHONE 253.627.1520
Tacoma, Washington 98402-4323 FAX 253.627.1923

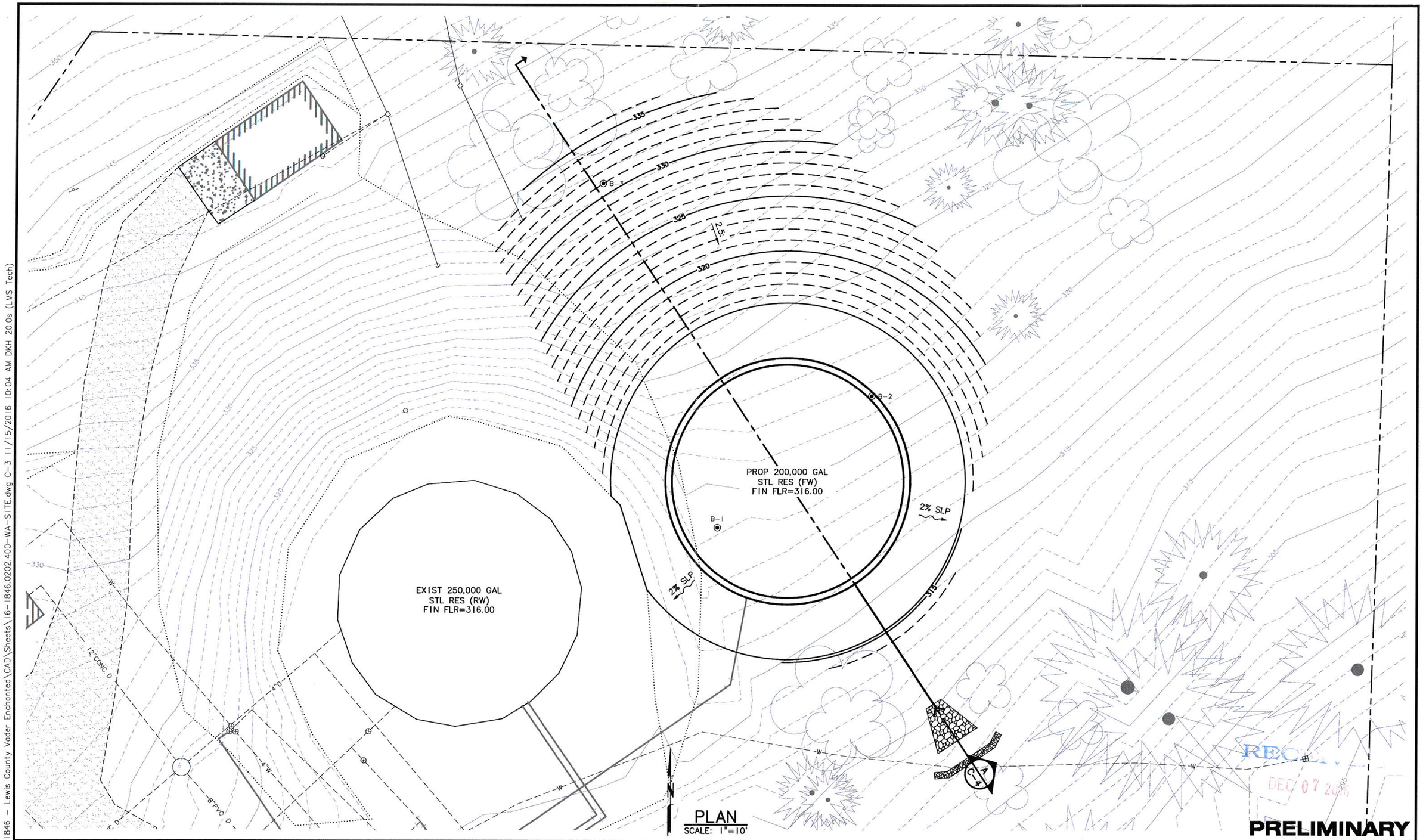
LEWIS COUNTY

VADER-ENCHANTED VALLEY RESERVOIR

EROSION CONTROL PLAN

PROJECT NO.: 16-1846.202 | SCALE: AS SHOWN | DATE: NOVEMBER 2016

SHEET C-2 X of X



PLAN
SCALE: 1"=10'

PRELIMINARY

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PRELIMINARY ONLY
NOT FOR CONSTRUCTION
NOVEMBER 2016
MURRAY, SMITH & ASSOCIATES, INC.

MSA Murray, Smith & Associates, Inc.
Engineers/Planners
400 E. Mill Plain Blvd., Suite 203 PHONE 360.448.4230
Vancouver, Washington 98660 FAX 360.448.4239

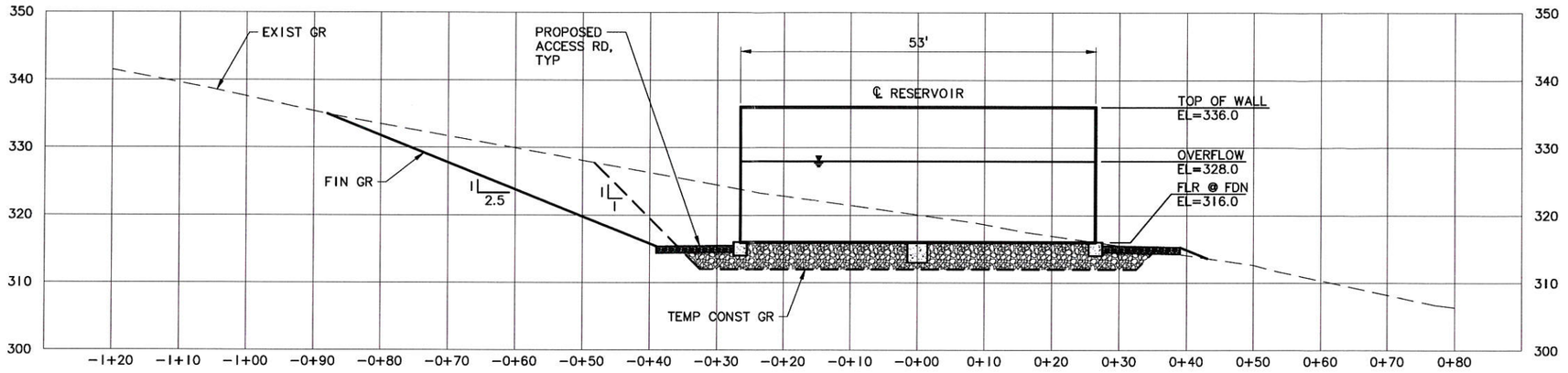
LEWIS COUNTY
Washington's First County
est. 1845

VADER-ENCHANTED VALLEY RESERVOIR

RESERVOIR SITE AND GRADING PLAN

PROJECT NO.: 16-1846.202 | SCALE: AS SHOWN | DATE: NOVEMBER 2016

SHEET C-3 X of X



RESERVOIR SITE SECTION A
SCALE: 1"=10' HORIZ; 1"=10' VERT

A
C-3

PRELIMINARY

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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KLT DESIGNED
DKH DRAWN
KLT CHECKED

PRELIMINARY ONLY
NOT TO BE USED FOR CONSTRUCTION
KEVIN L. TORGESON
EXPIRES: 12-31-2016
NOVEMBER 2016
MURRAY, SMITH & ASSOCIATES, INC.

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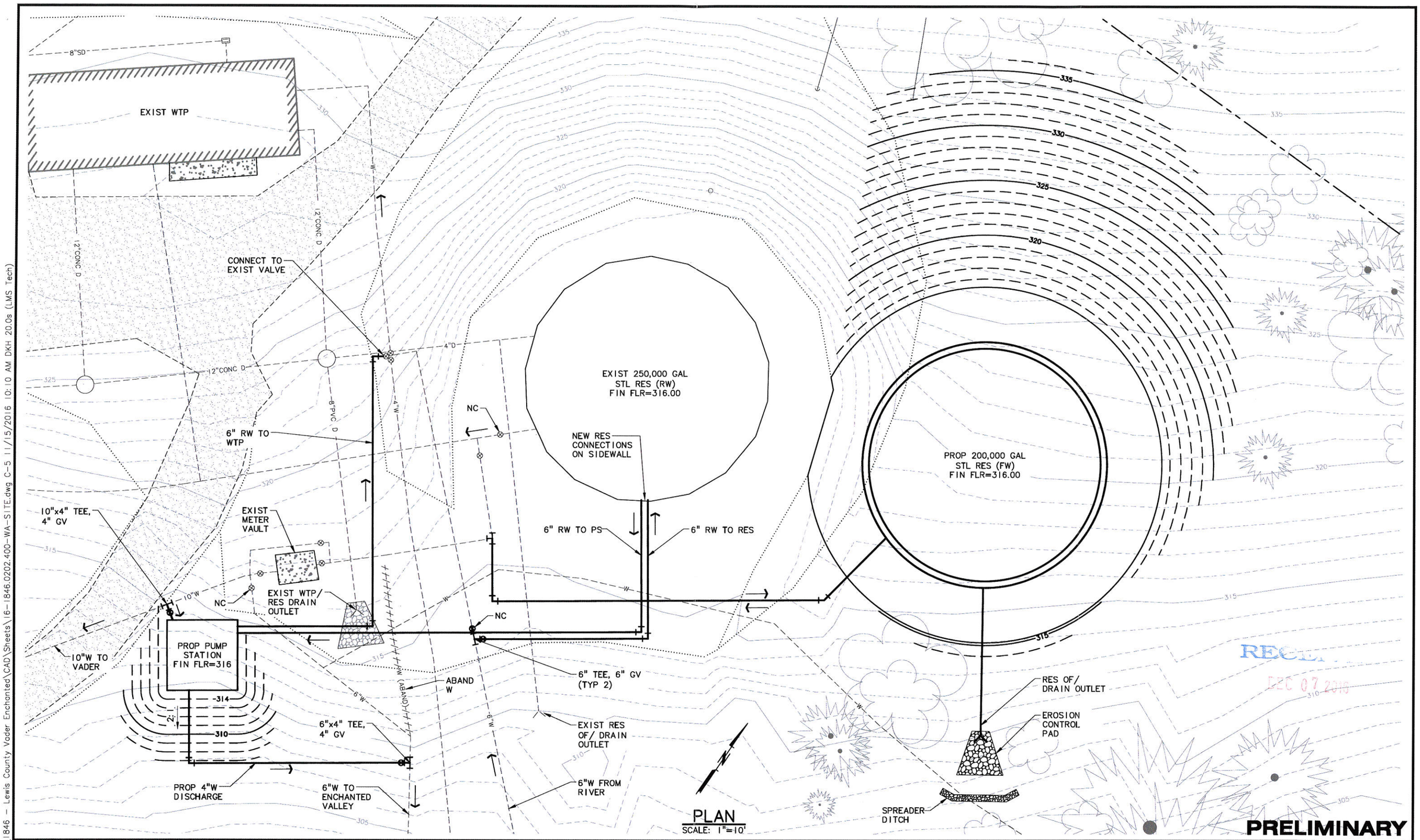
LEWIS COUNTY
Washington's First County
est. 1845

VADER-ENCHANTED VALLEY RESERVOIR

RESERVOIR SITE SECTION A

PROJECT NO.: 16-1846.202 | SCALE: AS SHOWN | DATE: NOVEMBER 2016

SHEET
C-4
X of X



PLAN
SCALE: 1"=10'

PRELIMINARY

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NO.	DATE	BY	REVISION

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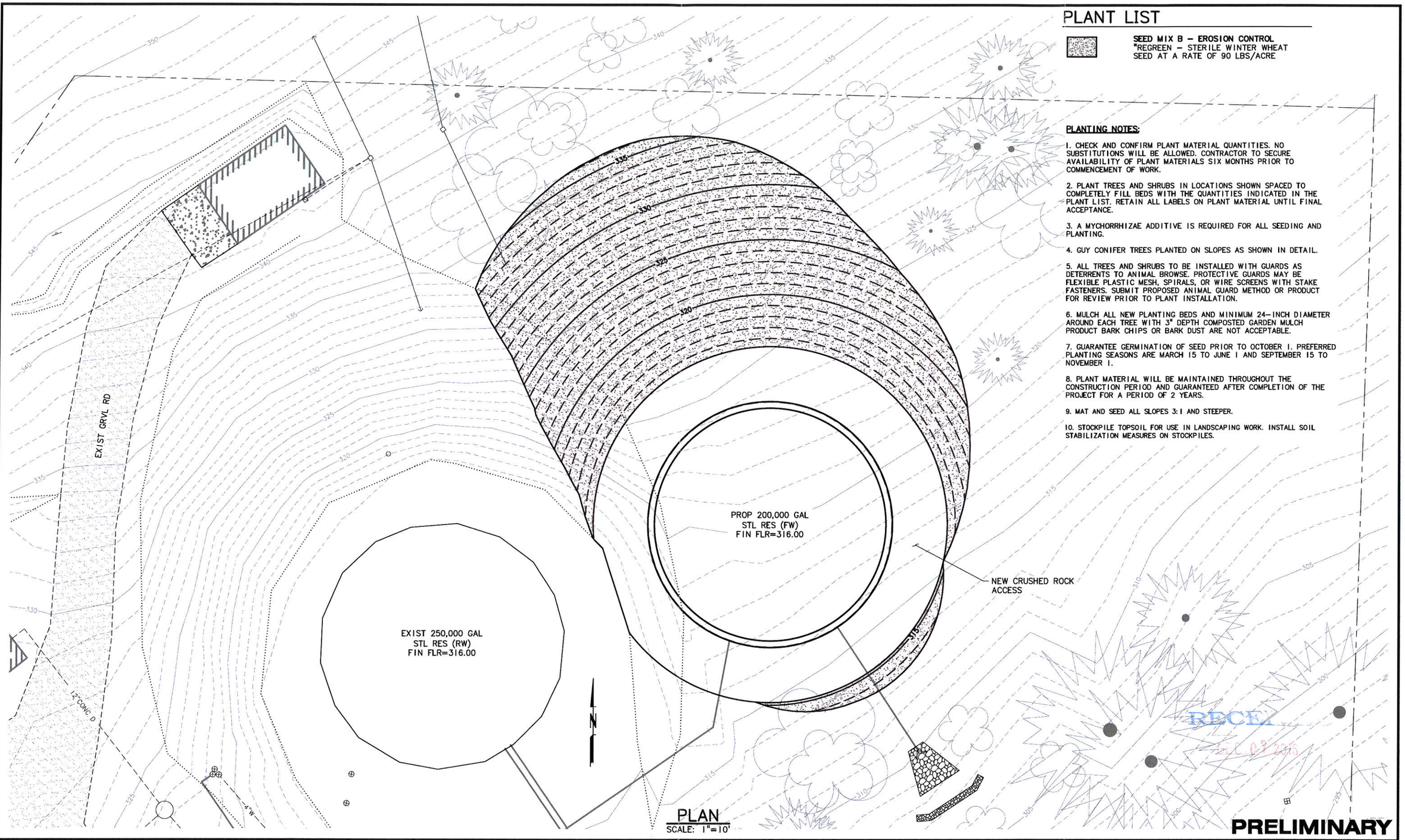
LEWIS COUNTY
Washington's First County
est. 1845

VADER-ENCHANTED VALLEY RESERVOIR

RESERVOIR SITE UTILITY AND DRAINAGE PLAN

PROJECT NO.: 16-1846.202 | SCALE: AS SHOWN | DATE: NOVEMBER 2016

SHEET C-5 X of X



PLAN
SCALE: 1"=10'

PLANT LIST

SEED MIX B – EROSION CONTROL
"REGREEN – STERILE WINTER WHEAT
SEED AT A RATE OF 90 LBS/ACRE

PLANTING NOTES:

1. CHECK AND CONFIRM PLANT MATERIAL QUANTITIES. NO SUBSTITUTIONS WILL BE ALLOWED. CONTRACTOR TO SECURE AVAILABILITY OF PLANT MATERIALS SIX MONTHS PRIOR TO COMMENCEMENT OF WORK.

2. PLANT TREES AND SHRUBS IN LOCATIONS SHOWN SPACED TO COMPLETELY FILL BEDS WITH THE QUANTITIES INDICATED IN THE PLANT LIST. RETAIN ALL LABELS ON PLANT MATERIAL UNTIL FINAL ACCEPTANCE.

3. A MYCHORRHIZAE ADDITIVE IS REQUIRED FOR ALL SEEDING AND PLANTING.

4. GUY CONIFER TREES PLANTED ON SLOPES AS SHOWN IN DETAIL.

5. ALL TREES AND SHRUBS TO BE INSTALLED WITH GUARDS AS DETERRENTS TO ANIMAL BROWSE. PROTECTIVE GUARDS MAY BE FLEXIBLE PLASTIC MESH, SPIRALS, OR WIRE SCREENS WITH STAKE FASTENERS. SUBMIT PROPOSED ANIMAL GUARD METHOD OR PRODUCT FOR REVIEW PRIOR TO PLANT INSTALLATION.

6. MULCH ALL NEW PLANTING BEDS AND MINIMUM 24–INCH DIAMETER AROUND EACH TREE WITH 3" DEPTH COMPOSTED GARDEN MULCH PRODUCT BARK CHIPS OR BARK DUST ARE NOT ACCEPTABLE.

7. GUARANTEE GERMINATION OF SEED PRIOR TO OCTOBER 1. PREFERRED PLANTING SEASONS ARE MARCH 15 TO JUNE 1 AND SEPTEMBER 15 TO NOVEMBER 1.

8. PLANT MATERIAL WILL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD AND GUARANTEED AFTER COMPLETION OF THE PROJECT FOR A PERIOD OF 2 YEARS.

9. MAT AND SEED ALL SLOPES 3:1 AND STEEPER.

10. STOCKPILE TOPSOIL FOR USE IN LANDSCAPING WORK. INSTALL SOIL STABILIZATION MEASURES ON STOCKPILES.

PRELIMINARY

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Vancouver, Washington 98660 FAX 360.448.4239

LEWIS COUNTY

VADER-ENCHANTED VALLEY RESERVOIR

RESERVOIR SITE PLANTING PLAN

PROJECT NO.: 16–1846.202 | SCALE: AS SHOWN | DATE: NOVEMBER 2016

SHEET C–7 X of X

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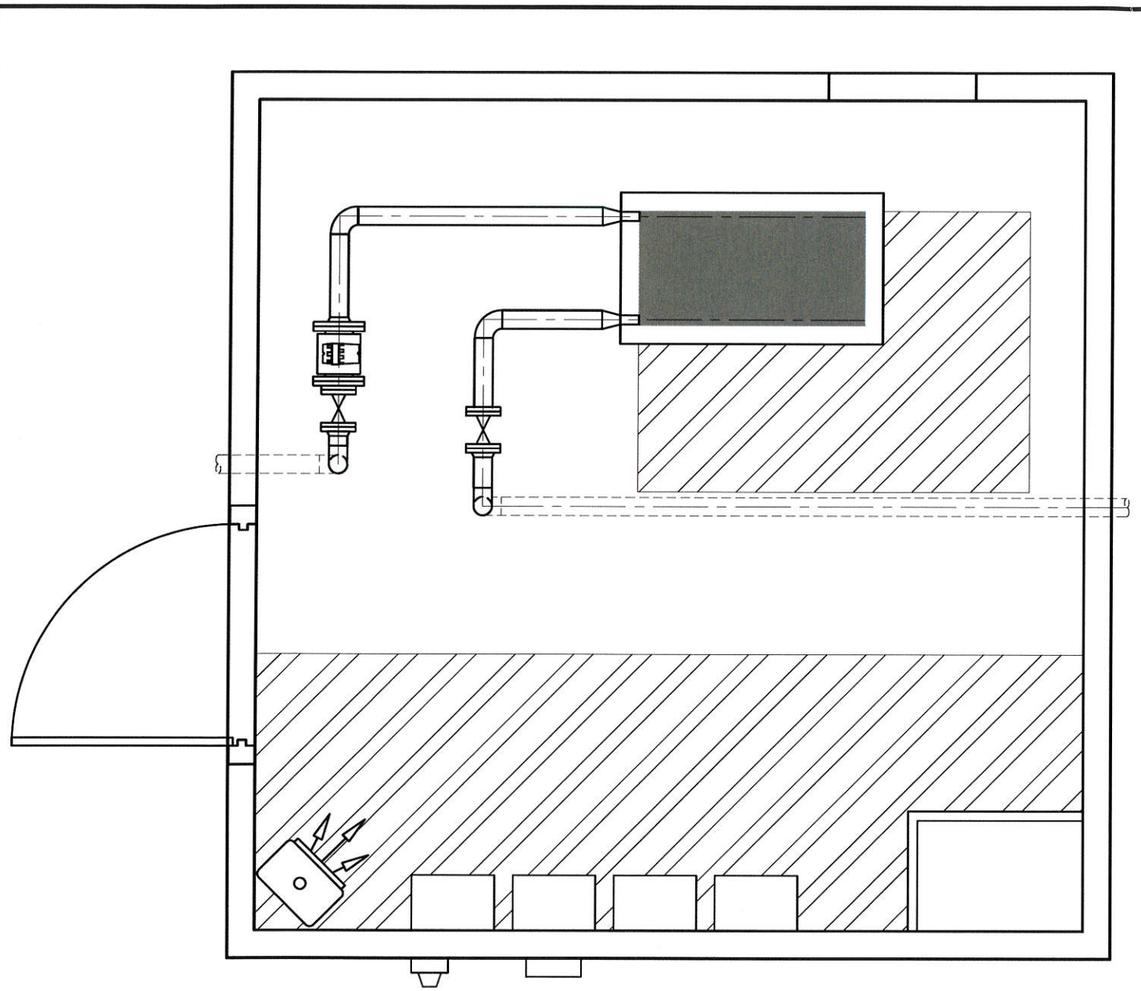
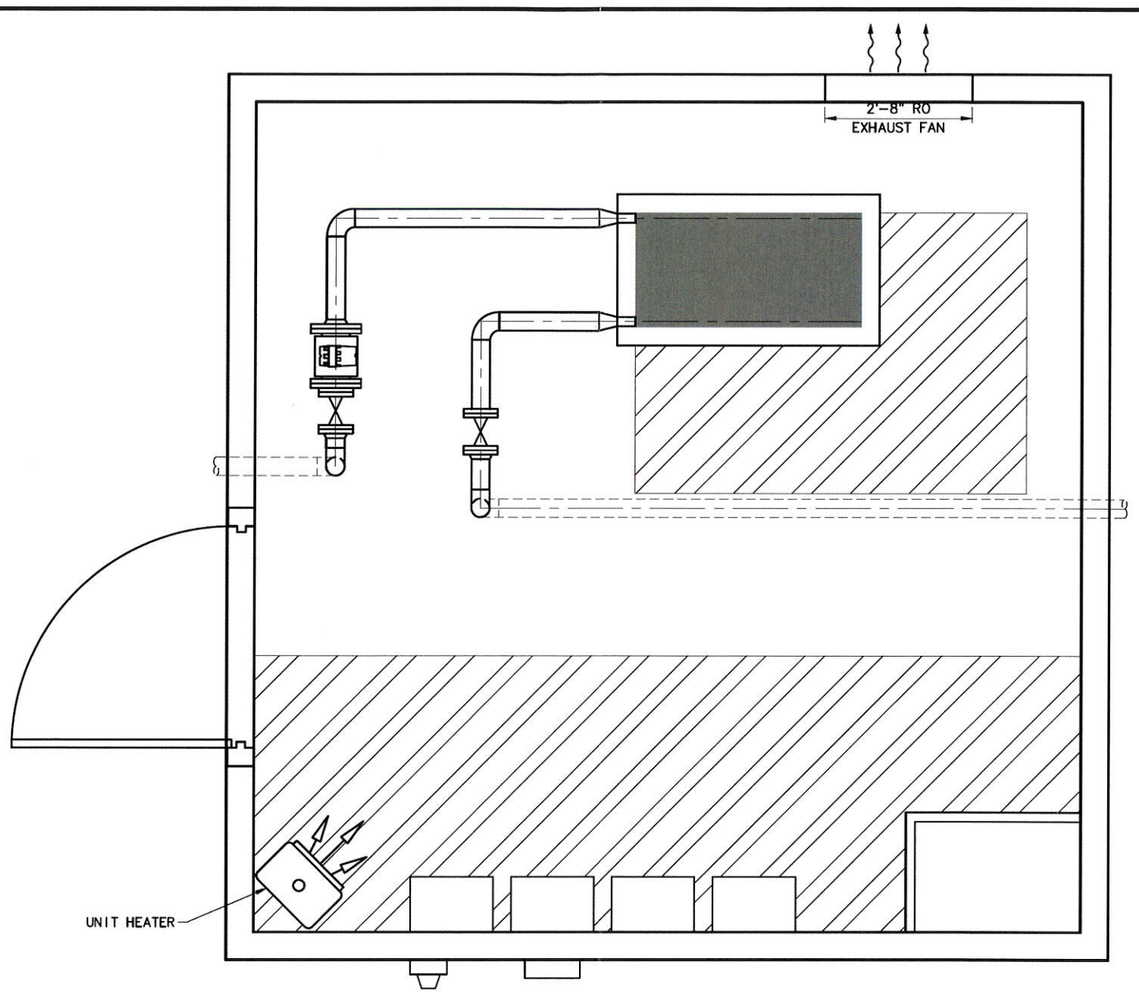


PLUMBING PLAN
SCALE: 3/4"=1'-0"



HVAC PLAN
SCALE: 3/4"=1'-0"

PRELIMINARY

NO.	DATE	BY	REVISION

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0 ½ 1
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NOVEMBER 2016
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Vancouver, Washington 98660 FAX 360.448.4239

LEWIS COUNTY

VADER-ENCHANTED VALLEY RESERVOIR

PUMP STATION - PLUMBING AND HVAC PLAN

PROJECT NO.: 16-1846.202 | SCALE: AS SHOWN | DATE: NOVEMBER 2016

SHEET M-1 X of X

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DEVELOPMENT PERMIT

Lewis County Community Development
2025 NE Kresky Avenue
Chehalis, WA 98532
360-740-1133 – Inspection line
360-740-1146 – Office
www.lewiscountywa.gov – web site

PERMIT NO.:	**B16-00898**
TYPE:	**BUILDING**
SUB:	OTHER NON-RESIDENTIAL
ISSUED:	**03/08/2018**
AUTHORIZED/ISSUED BY:	

Authorization to perform the following work and/or development, consistent with the approved plans and documents submitted in the application

PROJECT DESCRIPTION: 250,000 gallon water storage reservoir
Total Sq. Ft.: 2 Occupancy: U Const. Type: VB Valuation: $700,200.00

ASSOCIATED PERMITS: G16-00090, SW17-00014

SITE ADDRESS: 1333 S MILITARY RD , VADER **Tax Parcel No: 012546002002**
Legal Description: Section 28 Township 11N Range 02W PT SW SW LT 2 Utility Lot Segregation 3412863

Is granted to:

APPLICANT:
LEWIS COUNTY PUBLIC WORKS DEPT
2025 NE KRESKY AVE
CHEHALIS, WA 98532

OWNER:
LEWIS COUNTY
2025 NE KRESKY AVE
CHEHALIS, WA 98532

Requirements for Final Inspection:

- Stormwater Permit must be final approved
- Grading Permit must be final approved

This permit is issued on the express condition that the above-described work shall conform in all respects to all statements and documents submitted in the application herefore, and shall conform to any specific requirements of any other associated permit issued by the County. It shall be the responsibility of the permit holder to verify if any other local, state and/or federal permit or approval is required for the performance of the above-described work.

It is the responsibility of the permit holder (applicant) to cause the required inspections to be made. The County or any official or employee thereof shall not be liable for any direct or consequential damages whatsoever resulting from a failure of the permit holder (applicant) to secure the required inspections and comply with any correction notice issued. Any deviation from the work described in this permit, the application therefor or any supporting document shall be cause for the County to require a subsequent review and approval process.

By applying for this development permit, the applicant has agreed to comply with all applicable regulations of the County and all conditions of approval of this permit. Construction shall not start on any deferred submittals until such plans have been reviewed and approved by the County.

Conditions of Permit

- This permit expires 180 days from the date of issue if no substantial progress is made.
- All work shall conform to the requirements of the 2015 International Building and/or Residential Codes and other applicable laws and ordinances.
- All development must comply with the conditions set forth in the attached Lewis County Planning Review.
- All associated permits to be final approved prior to or at the time of final approval of this permit.
- It is the responsibility of the property owner and/or their contractor to ensure this structure meets the minimum setbacks (as set by Lewis County code) from all rights of way, easements and property lines. Failure to do so will invalidate this permit and may result in the requirement to remove this structure.
- Post inspection record and plans on the jobsite for inspections.
- All fees and fines must be paid prior to final inspection.

NOTICES

AMERICANS WITH DISIBILITY ACT: This project may be subject to the architectural standards of the Americans with Disabilities Act (ADA) of 1990. Issuance of a County development permit does not certify or assure compliance with the Federal Statute. Copies of the guidelines and information concerning the ADA may be obtained thru the Architectural and Transportation Barriers Compliance Board (1-202-653-7834 [voice or TDD] or 1/800-872-2253). Failure to comply with the Federal Statute (ADA) may result in Federal fines and penalties.

ELECTRICAL WORK: A separate permit is required for electrical work. Contact Washington State Department of Labor and Industries (L & I) Electrical Inspector at (360) 902-6350 (Tumwater) or 360-575-6900 (Longview). L & I final approval must be completed prior to occupancy or final inspection.

INSPECTIONS: If the permit holder fails to notify the Building Official that construction has commenced to a point that inspection is appropriate and work is covered before inspection, the Building Official is empowered to require uncovering such work to permit proper inspection. A minimum **twenty-four (24) hour notice** must be given to assure prompt inspection service. Inspections can be scheduled by calling the inspection line at 360-740-1133.

OCCUPANCY: Occupancy of any residence or structure prior to written authorization by the Lewis County Building Department is prohibited. Unauthorized occupancy will result in fines and/or penalties being assessed. Receipt of payment for any fines or penalties must be paid prior to any further inspections being scheduled.

PERMIT CHANGE REQUEST: Any change to the building permit or the construction plans associated with this permit after the permit has been issued will be assessed a $50.00 change fee. This fee will be in addition to any fees calculated for the change.

PERMIT EXPIRATION & REFUNDS: This permit becomes null and void if work or construction is not commenced within 180 days or if construction or work is suspended or abandoned for a period of 180 days at any time after work is commenced. The Building Official may authorize the refunding of not more than 80% of the base permit fee paid when no work has been done under a permit and upon written request filed by the original permittee not more than 180 days after the date of fee payment. Fees paid for building plan reviews, planning review and state fees are non-refundable.

SALES TAX - NOTICE TO CONTRACTORS: For all projects in unincorporated Lewis County, please report sales tax to CODE 2100. Projects in the City limits should be reported to the designated City codes. If you have questions call the Lewis County Treasurer's Office at 360-740-1116 or toll free (within Lewis County) at 1-800-562-6130 ext. 1116.

SOLID WASTE DISPOSAL: Lewis County Code (LCC) prohibits any person from disposing of solid waste generated or collected within Lewis County in a manner inconsistent with the process described throughout LCC 8.15. This county code requires that all solid waste collected or generated within Lewis County, unless source separated recycling, must be disposed of at a Lewis County owned, operated and permitted facility. The staff of the Solid Waste Division is available to assist and advise on proper disposal methods by calling 360 740 1451 or 1 800 749 5980.

SPECIAL TAX PROGRAMS: If your parcel is in a special tax program such as Open Space Farm and Agriculture Land, Open Space Timber, or Designated Forest Land, you must personally advise the Assessor's Office of any change in use of the land. Consideration of special tax programs is NOT part of the permitting process and may involve considerable additional expense. You may reach the Assessor's Office at (360) 740-1392.

LEWIS COUNTY
PLANNING REVIEW

Parcel No.: 012546002002

Status: **APPROVED**
Applicant: LEWIS COUNTY PUBLIC WORKS DEPT
Review #: PR16-00830
Application #: SEP16-0040, B16-00898 & G16-00090
Project: 2,416 cy cut/Fill and addition of 250,000 water storage reservoir
Date: 01/26/2017

CONDITIONS OF DEVELOPMENT

Based upon review of the Lewis County Code Titles 15, 16 & 17, the following conditions apply to your project:

1. *Discharge of petroleum or hazardous materials to any ditch, swale, or other non-impervious surfaced area, where migration to an aquifer is reasonably likely, is prohibited.

2. *Buried tanks of any petroleum or hazardous materials shall be prohibited unless the tanks are double-walled and equipped with a leakage monitoring system. Installation of the system shall be certified by the Property Owner or his/her agent. Placement of any buried tanks shall be undertaken only when approval is granted by the Washington State Department of Ecology.

3. *Oil-water separators shall be required for new impervious surface areas of 5,000 square feet or larger.

4. *All development must comply with the requirements of Seismic Risk Zone D-1.

5. *Nothing of a commercial, business, or industrial nature will be constructed, maintained, or suffered to be constructed or maintained on the said land of the grantor(s).

6. *The applicant shall meet the minimum requirements of LCC Chapter 15.45, erosion and sediment control.

7. *The applicant shall obtain all other required local, state and federal permits and approvals.

8. This parcel is located in Flood Zone C, typically areas of minimal flooding. Development in these areas shall be consistent with the Lewis County Flood Damage Prevention Ordinance LCC 15.35.

9. The parcel is located in the City of Vader UGA, however no interlocal UGA Agreement is in place with the City, so all development shall conform to the requirements of the Rural Development District Zoning District, One Residence per 5 acres (RDD-5), per Lewis County Code Title 17.100.

Karen Witherspoon, AICP
Senior Project Planner

Note: * denotes a general requirement

LEWIS COUNTY – STATE ENVIRONMENTAL POLICY ACT
THRESHOLD DETERMINATION
DETERMINATION OF NONSIGNIFICANCE (DNS)

LEAD AGENCY: Lewis County--Community Development Department

PROPONENT: Lewis County – Public Works (Ann Weckback)

FILE NUMBERS: SEP16-0040

DESCRIPTION OF PROPOSAL: Construction of a new 250,000 gallon water reservoir for the Vader Water System, including approximately 2,416 cubic yards of cut/fill as site preparation for the reservoir site

LOCATION OF PROPOSAL: The project is located at the Vader Water Treatment Plant, 1333 S Military Road in Lewis County, Washington on parcel number 012546-002-002 – Section 28, Township 11N, Range 02W, WM.

THRESHOLD DETERMINATION:
The lead agency for this proposal has determined that it does not have a probable, significant adverse impact on the environment. An environmental impact statement (EIS) is NOT required under RCW 43.21C.030(2)(c). This decision was made after review by Lewis County of a completed environmental checklist and other information on file with this agency and such information is adopted herein by reference. This information is available for public review upon request.

This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 14 days from the issue date below. Comments may be submitted during the 14 day period.

Responsible Official: **Lee Napier, Director**
Lewis County Community Development
2025 NE Kresky Avenue
Chehalis, Washington 98532

Contact Person: **Karen A. Witherspoon, AICP, Senior Project Planner**

for Responsible Official

Date of Issue: **January 4, 2017**

This SEPA determination may be appealed to the Lewis County Hearings Examiner until close of business on January 25, 2017. Appellants should be prepared to make ***specific factual objections****. Details regarding the appeal procedure may be obtained from the Responsible Official.*

FPA/N No: 2932829
Effective Date: 2/16/2017
Expiration Date: 2/16/2020
Shut Down Zone: 655
EARR Tax Credit: [ ] Eligible [x] Non-eligible
Reference: 28-11-02W

Forest Practices Application/Notification
Notice of Decision

Decision

[ ] Notification	Operations shall not begin before the effective date.
[x] Approved	This Forest Practices Application is subject to the conditions listed below.
[ ] Disapproved	This Forest Practices Application is disapproved for the reasons listed below.
[ ] Closed	Applicant has withdrawn FPA/N.

FPA/N Classification

[ ] Class II [ ] Class III [ ] Class IVG [x] Class IVS

Number of Years Granted on Multi-Year Request

[ ] 4 years [ ] 5 years

Conditions on Approval / Reasons for Disapproval

No additional conditions.

Issued By: Meg Wallmow **Region:** Pacific Cascade Region

Title: Forest Practices Forester **Date:** 2/16/2017

Copies to: **[x] Landowner, Timber Owner and Operator.**

Issued in person: **[ ] Landowner [ ]Timber Owner [ ] Operator By:**_____

Appeal Information

You have thirty (30) days to appeal this Decision and any related State Environmental Policy Act determinations to the Pollution Control Hearings Board in writing at the following addresses:
Physical address: 1111 Israel Rd. SW, Ste 301, Tumwater, WA 98501
Mailing address: P.O. BOX 40903, OLYMPIA, WA 98504-0903
Information regarding the Pollution Control Hearings Board can be found at: http://www.eluho.wa.gov/
At the same time you file an appeal with the Pollution Control Hearings Board, also send a copy of the appeal to the Department of Natural Resources' region office and the Office of the Attorney General at the following addresses:

Office of the Attorney General
Natural Resources Division
1125 Washington Street SE
PO Box 40100
Olympia, WA 98504-0100

And

Department Of Natural Resources
Pacific Cascade Region
PO Box 280
Castle Rock WA 98611

Other Applicable Laws

Operating as described in this application/notification does not ensure compliance with the Endangered Species Act, or other federal, state, or local laws.

Transfer of Forest Practices Application/Notification (WAC 222-20-010)

Use the "Notice of Transfer of Approved Forest Practices Application/Notification" form. This form is available at region offices and on the Forest Practices website: **http://www.dnr.wa.gov/businesspermits/forestpractices**. Notify DNR of new Operators within 48 hours.

Continuing Forest Land Obligations (RCW 76.09.060, RCW 76.09.070, RCW 76.09.390, and WAC 222-20-055)

Obligations include reforestation, road maintenance and abandonment plans, conversions of forest land to non-forestry use and/or harvest strategies on perennial non-fish habitat (Type Np) waters in Eastern Washington.

Before the sale or transfer of land or perpetual timber rights subject to continuing forest land obligations, the seller must notify the buyer of such an obligation on a form titled "Notice of Continuing Forest Land Obligation". The seller and buyer must both sign the "Notice of Continuing Forest Land Obligation" form and send it to the DNR Region Office for retention. This form is available at DNR region offices.

If the seller fails to notify the buyer about the continuing forest land obligation, the seller must pay the buyer's costs related to continuing forest land obligations, including all legal costs and reasonable attorneys' fees incurred by the buyer in enforcing the continuing forest land obligation against the seller.

Failure by the seller to send the required notice to the DNR at the time of sale will be prima facie evidence in an action by the buyer against the seller for costs related to the continuing forest land obligation prior to sale.

DNR affidavit of mailing:

On this day 2/16/2017 (date), I placed in the United States mail at Castle Rock (post office location), WA, postage paid, a true and accurate copy of this document. Notice of Decision FPA # 2932829

Tonya Johnston (Printed name)

(Signature)