



TECHNICAL SPECIFICATIONS

SECTION 01 10 00 - SUMMARY OF WORK

PART 1 GENERAL

This Summary of Work supplements and amplifies certain sections of the General Conditions. The General Conditions shall apply except as modified herein. These Special Provisions and additional 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

- A. The following references apply except as may be modified herein. In the case of discrepancy, unless noted otherwise herein, the more restrictive provisions shall apply.
- B. The requirements of the City of Roseburg Public Works Department.
- C. 2018 edition of the Oregon Standard Specifications for Construction, Oregon Department of Transportation, herein referred to as "Standard Specifications".
- D. Most current edition of the Oregon Standard Drawings and Details, Oregon Department of Transportation, herein referred to as "Standard Plans".

1.2 SCOPE OF WORK

The work to be performed under these specifications and drawings consists of construction of approximately 2,894 linear feet of 24-inch diameter potable water transmission main along NE Stephens Street from Hooker Road to Isabell Avenue to replace an existing transmission main including fittings, valves, combination air release valves, low point blow-off and drain assemblies, and corrosion monitoring system; trenchless installation of steel casing to cross underneath Davis Creek; abandonment of an existing and installation of a new transmission mains intertie; connections to existing distribution and transmission mains; HDD installed pipe casing underneath railroad right-of-way to replace an existing crossing; abandonment of existing water distribution and transmission mains; surface restoration, pavement restoration, traffic control and the performance of any other work as called for by the project plans and specifications.

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
- I. General Conditions of the Contract
- J. Standard Specifications
- K. 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. 20-2938. and the general title:

PROJECT #20WA17
24-INCH TRANSMISSION MAIN
HOOKER ROAD TO ISABELL AVENUE
CITY OF ROSEBURG, OREGON

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

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. Oregon State Department of Labor and Industries
- G. City of Roseburg – Code of Ordinances

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

1.5 TIME OF COMPLETION/LIQUIDATED DAMAGES

The CONTRACTOR shall complete all work shown and specified within the time limits stated in the Agreement (See Section 01 33 00, Submittal Procedures, for project schedule submittal requirements). The written Notice to Proceed will be sent to the CONTRACTOR after the CONTRACTOR submits the signed Contract, Bonds and insurance certificates to the OWNER and those documents have been approved as to form and executed by the OWNER. The CONTRACTOR's attention is directed to Item No. 11 of the Bid Form, Item No. 4 of the Construction Contract, and the General Conditions as respects liquidated damages.

1.6 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.

1.7 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.

1.8 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.

1.9 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 based on the information made available.

1.10 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 make its own arrangements for obtaining a potable water supply for flushing, testing, and disinfection of the pipelines and appurtenant facilities. Water supply may be made available to the contractor from the City of Roseburg water system depending upon the operational status of its existing reservoirs, water demands, other water needs, and other factors.

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. Water supply fire hydrant use is allowed only by permission of the utility owner. Backflow protection is required on all connections to potable water systems.

1.11 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.

1.12 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.

The following permits are to be obtained by the Contractor:

- City of Roseburg Public Works Department, Permit to do Construction or Utility Work Within the Public Right-of-Way (with Traffic Control Plan submittal)

The following permits are to be obtained by the Owner:

- Douglas County Public Works Department, Application for Right of Way Activity Permit (for HDD and Water service connection on Hooker Road)

1.13 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 3.10 of the General Conditions regarding safety and the protection of property. Certain portions of this project require working near 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 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.

1.14 RAILROAD CROSSINGS AND RIGHT OF ENTRY

Whenever a utility passes under a railroad or is on or sufficiently near 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.

The Contractor shall not enter or work within the railroad right-of-way without obtaining a right of entry permit from Central Oregon Pacific Railroad (COPR). If the Contractor elects to access the railroad right-of-way, a right of entry permit application shall be submitted to RailAmerica, Real Estate Department. All fees associated with this application are to be paid for by the Contractor. Upon receiving approval, the Contractor shall provide the Owner and Engineer with the proper documentation for their records.

1.15 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.

1.16 TRAFFIC CONTROL AND PROTECTION

The CONTRACTOR shall maintain traffic control and protection in all of the work areas twenty-four (24) hours per day. Traffic control shall conform to the standards set forth in the latest edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways" (MUTCD) and any modifications to that manual contained herein or any other requirements as prescribed by any agency with authority over the project.

General requirements for providing traffic control and traffic control plans for specific work zones within the project area have been provided herein these specifications and included in the drawings. This furnished traffic control info shall not be construed as comprehensive and shall be considered as minimum requirements for providing traffic control for the work.

Prior to beginning construction, the CONTRACTOR shall submit a detailed street closure and traffic control plan to the ENGINEER. This plan shall address any traffic impacts to NE Stephens Street, Hooker Road/Keller Road, NE Jerrys Drive, Kenneth Ford Drive, Costco's north and south driveways, NE Timberlake Street, Promise Avenue, Mobridge Avenue, and NE Isabell Avenue. The closure and traffic control plan shall be prepared in accordance with the Oregon Department of Transportation Traffic Control Plans Design Manual. This plan shall be organized to address the closure and traffic control requirements of the MUTCD and the City of Roseburg. The ENGINEER will submit the plan to the City of Roseburg for their review. The CONTRACTOR shall modify or correct the plan and resubmit the plan, as required by either agency, as necessary to obtain approval. Construction may not proceed until approval has been obtained.

All work shall be carried on with due regard for safety to the public. Work zone areas shall be provided with barricades of a type that can be seen at a reasonable distance. Work zone areas shall be distinctly indicated at night by adequately placed lighting which shall consist of a minimum of two lighting plants within the work zone. The CONTRACTOR shall designate an individual on the project to be its traffic control superintendent. The CONTRACTOR shall work with the OWNER in support of its public relations program as described elsewhere in this Summary of Work to provide notification of construction activities and road closures to the City of Roseburg and local residents, businesses, school districts, and other institutions and agencies. See Section 01 55 26, Traffic Control for additional information and requirements.

1.17 MATERIALS AND COMPACTION TESTING

The CONTRACTOR shall provide, at no additional cost to the OWNER, the services of a licensed, independent agency to perform materials and compaction testing for this project. The agency must be approved by the ENGINEER. The scope of services to be performed by the agency include the following: soil and aggregate classification and testing; soil and aggregate compaction testing; concrete strength testing as required; and hot mixed asphalt concrete (HMAC) testing and compaction. Materials and compaction tests will be required to show that specified densities of compacted backfill and asphaltic concrete surfacing are

being achieved by the CONTRACTOR's compaction methods. The CONTRACTOR shall provide the ENGINEER with copies of recent Proctor tests for the backfill and paving material in addition to copies of compaction tests performed in the field.

After the ENGINEER is satisfied that the CONTRACTOR's method of compaction consistently meets specified compaction requirements, the testing frequency may be reduced. The ENGINEER may direct testing at a higher frequency upon failure to obtain specified densities or if the CONTRACTOR changes compaction equipment or methods of compaction. All test locations shall be determined by the ENGINEER.

1.18 DECHLORINATION AND DISPOSAL OF CHLORINATED WATER

Any discharge of chlorinated water shall either be through an approved connection to a public sanitary sewer system or shall include dechlorination to limits acceptable by the Oregon State Department of Environmental Quality (DEQ) for discharge into the existing storm drainage system. No chlorinated water shall be discharged into the storm drainage system prior to approved dechlorination treatment.

1.19 LIMITS OF THE WORK AND STOCKPILE AND STAGING PLAN

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.

The CONTRACTOR shall submit a stockpile and staging plan to the ENGINEER. This plan will describe the CONTRACTOR's plan for stockpiling and staging of construction materials and equipment on the project site. This plan will include no stockpiling of materials allowed on the non-trenched lanes. Stockpiling of materials will only be allowed on areas where the pavement is being overlaid.

If the CONTRACTOR makes arrangements with private or public landowners for use of property outside of public rights-of-way for stockpiling and staging, then the CONTRACTOR shall submit documentation to the ENGINEER that the CONTRACTOR warrants that its activities comply with all environmental, land use and any other requirements under all Federal, State and local statutes and codes. The CONTRACTOR shall also submit documentation of permission from the property owner for the proposed activity. Upon completion of construction, the CONTRACTOR shall submit to the ENGINEER a release from the property owner confirming that the property has been restored to the satisfaction of the owner and that all obligations have been satisfied.

1.20 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 per the Specifications. See Section 01 12 16, *Work Sequence and Schedule Constraints*, for requirements.

1.21 FIELD CHANGES, ALIGNMENT AND GRADE

Changes of alignment and grade shall be made during the course of work in order to avoid interference with unforeseen obstructions. The CONTRACTOR shall locate existing utilities to be crossed, by potholing ahead of the pipe installation, of sufficient distance to avoid conflicts through pipe joint deflection if possible. All costs for minor field changes of alignment and grade shall be borne by the CONTRACTOR. The ENGINEER will endeavor to make prompt decisions on such matters. CONTRACTOR shall anticipate a minimum of 72 hours for any decision requiring significant piping change.

1.22 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.

1.23 PROTECTION OF EXISTING STRUCTURES AND WORK

The CONTRACTOR must take all precautions and measures necessary to protect all existing structures and work. Any damage to existing structures and work shall be repaired by removing the damaged structure or work, replacing the work, and restoring to original condition satisfactory to the ENGINEER.

1.24 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.

1.25 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.

1.26 PUBLIC SAFETY AND CONVENIENCE

General Rule: The CONTRACTOR shall ensure the safety of the public during its performance of the Work and shall minimize any public inconvenience in addition to any other requirement imposed by law. These duties include, but are not limited to, the matters listed below.

Access: The CONTRACTOR shall not unreasonably restrict access to public facilities, commercial property, fire hydrants, residential property, and other areas where the public can be expected to be present, such as sidewalks and streets without first obtaining approval of the OWNER. Driveways shall be closed only with the approval of the OWNER or after obtaining specific permission from the property owner or owners. In addition, the CONTRACTOR shall not obstruct or interfere with travel over any public street or sidewalk without approval of the OWNER.

Public Transit: The CONTRACTOR shall not interfere with the normal operation of any public transit vehicles unless otherwise authorized.

Work Site: The CONTRACTOR shall keep the Project site safe in compliance with applicable law. Safety includes, but is not limited to: 1) providing an approved type of secured and adequate barricades or fences that are easily visible from a reasonable distance around open excavations; 2) closing up or covering with steel plates all open excavations at the end of each Working Day in all street areas and in all other areas when it is reasonably required for public safety; 3) marking all open work and obstructions by lights at night; 4) installing and maintaining all necessary signs, lights, flares, barricades, railings, runways, stairs, bridges, and facilities; 5) observing any and all safety instructions received from the OWNER; and 6) following all laws and regulations concerning worker and public safety. In the event that the law requires greater safety obligations than that imposed by the OWNER, the CONTRACTOR shall comply with the law.

Emergency: Emergency vehicles, including but not limited to police, fire, and disaster units shall be provided access to the work site at all times.

Cleanliness: The CONTRACTOR shall, on a continuing basis, keep the surfaces of all public and private roadways, sidewalks, and other pathways free of dirt, mud, cold plane grindings, and other matters that the CONTRACTOR may place upon the road. The cost of performing such work shall be included in the CONTRACTOR's Bid and no additional payment will be made for performing this task.

Parking: Construction-related vehicles, including equipment and CONTRACTOR's employee's vehicles, shall not park along or in public or private roadways. This requirement may be waived should written permission be obtained by the governing jurisdiction or property owners. The CONTRACTOR shall make any necessary contacts with all applicable governmental bodies to arrange for the removal of parked automobiles, vehicles, and other obstructions if they would interfere with the performance of the CONTRACTOR'S work.

Accidents: The CONTRACTOR'S Project Manager or superintendent shall be in charge of accident prevention. CONTRACTOR shall take all actions necessary to prevent damage, injury and loss to persons and property as a result of accidents.

The OWNER has no responsibility for Work site safety. Work site safety is the responsibility of the CONTRACTOR. The CONTRACTOR is required to have a competent person on site at all times during construction activities.

The CONTRACTOR shall provide signs on work zone fencing that provide information regarding access to businesses and stating that such businesses are open and in operation. The CONTRACTOR shall furnish and install the signs and provide sign attachments for the various business names.

1.27 WARRANTY PERIOD

The CONTRACTOR shall warrant all furnished materials and equipment for a period of one 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.

1.28 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:

City of Roseburg	Water & Storm Sewer
Avista Utilities	Natural Gas
Roseburg Urban Sanitary Authority (RUSA)	Sanitary Sewer
Pacific Power	Power
Charter Communications	Cable
Level 3/CenturyLink	Telephone
Sprint/Nextel	Fiber Optic Cable
Douglas Services, Inc.	Telephone/Communications

1.29 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.

1.30 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.

1.31 VEHICLE PARKING

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

1.32 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.

1.33 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.

1.34 "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.

1.35 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 benchmarks, 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.

1.36 WORK HOUR LIMITATIONS

All work allowed to be performed during daytime hours, denoted as "DAY WORK" in the project drawings, shall be conducted between the hours of 7:00 a.m. and 7:00 p.m. on non-holiday weekdays only. No weekend work will be allowed. All work required to be performed

during nighttime hours, denoted as "NIGHT WORK" in the project drawings, shall be conducted between the hours of 7:00 p.m. and 7:00 a.m. Requests for variations in work hours shall be made in writing for consideration by the ENGINEER. No work shall be conducted outside of the above-described days and hours without prior approval of the ENGINEER.

1.37 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.

1.38 EROSION AND SEDIMENTATION CONTROL

The CONTRACTOR shall implement and maintain erosion control measures as required to prevent sediment from migrating from the project site. Erosion control measures shall conform to the standards set forth in the latest edition of the "Construction Stormwater Best Management Practices Manual" published by the Water Quality Division of the State of Oregon's Department of Environmental Quality (DEQ), and any modifications to that manual contained herein or any other requirements as prescribed by any agency with authority over the project.

General requirements for providing erosion and sediment control measures or Best Management Practices (BMP's) per DEQ's manual have been provided in the drawings for the CONTRACTOR's benefit. This furnished erosion control info shall not be construed as comprehensive and shall be considered minimum requirements for providing erosion and sediment control during the project work. Additional BMP's will be required to perform the work and the CONTRACTOR shall factor this into their bidding for the project.

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 documents. 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.

1.39 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.

1.40 NOISE LIMITATIONS

The project areas are located within a residential zoned area. All applicable City, County ordinances and State and Federal regulations shall be complied with.

1.41 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.

1.42 COMPETENT PERSON DESIGNATION

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

1.43 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.

1.44 PREVAILING WAGE RATES FOR PUBLIC WORKS CONTRACTS IN OREGON

The CONTRACTOR shall abide by ORS 279C.800 through 279C.870 which relate to the prevailing wage rates for the building and construction trades in the State of Oregon. These prevailing wage rates are shown in the Bureau of Labor and Industries document which is included elsewhere in these contract documents.

1.45 OREGON PRODUCTS

CONTRACTOR's attention is directed to the provisions of Oregon Law, ORS 279A.120 regarding the preference for products that have been manufactured or produced in Oregon. CONTRACTOR shall use Oregon-produced or manufactured materials with respect to common building materials such as cement, sand, crushed rock, gravel, plaster, etc., and Oregon-manufactured products in all cases where price, fitness, availability and quality are otherwise equal.

1.46 USE OF EXPLOSIVES

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

1.47 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 Oregon Revised Statutes (ORS) 465.200, as amended.
3. "Release" shall have the meaning as defined in ORS 465.200, as amended.
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.

1.48 SEQUENCE OF CONSTRUCTION REQUIREMENTS

See Specification Section 01 12 16, *Work Sequence and Schedule Constraints*.

1.49 CONSTRUCTION WITHIN STATE WATERS – NOT USED

1.50 PROJECT INFORMATION SIGNS – NOT USED

1.51 INADVERTENT DISCOVERY PLAN FOR CULTURAL RESOURCES

The CONTRACTOR shall follow this Inadvertent Discovery Plan (IDP) if cultural material including human remains are encountered during construction. In addition to the requirements below, the CONTRACTOR shall comply in all respects to the requirements of Section 00290.50, Protection of Cultural Resources and Section 00290.51, Protection of Sensitive Cultural Sites, Oregon Standard Specifications for Construction, Oregon Department of Transportation (ODOT).

The IDP for the project is as follows:

Protocol for Coordination in the Event of Inadvertent Discovery

- A. In the event of an inadvertent discovery of possible archaeological materials, all work will stop immediately in the vicinity of the find.
- B. The area will be secured and protected.
- C. The City's Archaeologist or the Resident Project Representative (RPR) will be notified. The RPR will notify the appropriate authorities which shall be Rural Development, USDA State Environmental Coordinator (SEC) and the State Historic Preservation Office (SHPO). If possible human remains are encountered, the RD SEC and the Lane County Coroner will be notified immediately. The RD SEC will then notify the SHPO and the appropriate Tribes. Contact names and numbers are as follows:

Rural Development, USDA: Charlotte Rollier, State Environmental Coordinator (RD SEC)
– 503-414-3356

State Historic Preservation Office: Dennis Griffin, Archeologist – 503-986-0674

- D. No work may resume until the City's Archeologist is on site and able to assess the situation.
- E. If human remains are encountered, do not disturb them in any way. *Do not call 911.* Do not speak with the media. Secure the location. Do not take photos.
- F. The City's Archeologist will consult with the RD SEC and SHPO, who will then contact the appropriate Tribal Governments and determine an appropriate course of action.
- G. Additional archeological excavations may be required. This work will be handled on a case-by-case basis by the City's Archaeologist in consultation with the RD SEC and SHPO and appropriate Tribes.

When to Stop Work

Construction work may uncover previously unidentified Native American or Euro-American artifacts. This may occur for a variety of reasons but may be associated with access restrictions during project development, or if the area contains impervious surfaces throughout most of the project area which would have prevented standard archaeological site discovery methods.

A. Work must stop when the following types of artifacts and/or features are encountered:

1. Native American artifacts may include (but are not limited to):
 - Flaked stone tools (arrowheads, knives scrapers etc.)
 - Waste flakes that resulted from the construction of flaked stone tools.
 - Ground stone tools like mortars and pestles.
 - Layers (strata) of discolored earth resulting from fire hearths. May be black, red or mottled brown and often contain discolored cracked rocks or dark soil with broken shell
 - Human remains
 - Structural remains- wooden beams, post holes, fish weirs
2. Euro-American artifacts may include (but are not limited to):
 - Glass (from bottles, vessels, windows etc.)
 - Ceramic (from dinnerware, vessels etc.)
 - Metal (nails, drink/food cans, tobacco tins, industrial parts etc.)
 - Building materials (bricks, shingles etc.)
 - Building remains (foundations, architectural components etc.)
 - Old wooden posts, pilings, or planks (these may be encountered above or below water)
 - Even what looks to be old garbage could very well be an important archaeological resource
 - Remains of ships or sea-going vessels, marine hardware etc.
 - Old farm equipment may indicate historic resources in the area

END OF SECTION

SECTION 01 12 16 - WORK SEQUENCE AND SCHEDULE CONSTRAINTS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes general sequencing, project phasing and coordination requirements for the Work.

1.2 RELATED SECTIONS

<u>Section/Division No.</u>	<u>Item</u>
01 10 00	Summary of Work

1.3 GENERAL CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

- A. Coordinate construction schedule and operation with OWNER and ENGINEER.
- B. Coordinate proposed work with OWNER and ENGINEER before implementing shutdowns of any water system facilities associated with the Project. Under no circumstances shall work cease at the end of a normal working day if such actions may inadvertently cause a cessation of any facility operating process; in which case, CONTRACTOR shall remain on site until necessary repairs are complete and full water system function is restored.
- C. Do not close lines, open valves, or take other action that would affect the operation of existing systems, except as specifically required by the Contract Documents and after approval of OWNER and ENGINEER.
- D. CONTRACTOR shall not operate any of the existing equipment or facilities without written permission from the OWNER naming the specific piece of equipment and dates the CONTRACTOR may use the equipment or facilities. The CONTRACTOR is liable for any loss or damage caused to property or equipment or facilities or any personal injury resulting from or related to this usage.

1.4 SUBMITTALS

- A. Submit a Work Sequencing Plan detailing the complete sequence of construction for all activities contained herein.
- B. Identify the following in the Work Sequencing Plan:
 - 1. Major work activities to occur.
 - 2. General schedule when work will occur. Submit separately a detailed schedule as specified in Section 01 33 00, Submittal Procedures. Incorporate materials in detailed schedule and work sequencing plan.

3. What assistance will be required of OWNER's operating personnel during shutdown and for start-up.
4. Contingency backup plan identifying what action will be taken if activities during a shutdown cannot be completed within the allotted times, or if there is a failure of the CONTRACTOR's temporary equipment.
5. Name of individual in charge of CONTRACTOR's activity during shutdown.

1.5 SHUTDOWN OF WATER TRANSMISSION MAIN

- A. Submit requests for shutdown of water transmission main not less than ten (10) business days in advance of the date scheduled for the interruption.
- B. Following receipt of the request, ENGINEER will notify the CONTRACTOR if the requested date will be permitted. Evaluation of the request will be based upon the availability of the utility owner's personnel to assist and monitor utilities during the shutdown period and impact to customer service.
- C. Minimize the period of interruption by thorough advance planning. Procure required materials, equipment and labor and have on hand during the shutdown.
- D. Do not begin interruption until written authorization is received from ENGINEER.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS FOR EXECUTION OF WORK

- A. Maintain overall coordination of execution of Work.
- B. Obtain all necessary permits for the work.
- C. Obtain schedules from subcontractors and suppliers and assume responsibility for correctness.
- D. Incorporate schedules from all parties into Progress Schedule to plan for and comply with sequencing constraints.
- E. Contractor shall pothole all crossing utilities where depths are unknown and where specified on the drawings, and also confirm all connections for water pipe prior to beginning pipe installation work for that respective pipeline to allow for proposed changes where necessary to be reviewed by Owner's Representative.

- F. Contractor shall install all erosion control measures in place as required prior to beginning work, maintain during work, and remove after work has been completed where and when conditions allow.
- G. Work requiring multiple lane closures and flagging along NE Stephens on the northern half of the project, from the Hooker Road intersection, through the Kenneth Ford Drive intersection, and to just south of the North Costco Driveway and center island, required to be completed at nighttime.
- H. See Specifications Section 01 10 00 – Summary of Work, subsection 1.36 for work hour limitations for work occurring during the daytime and nighttime (where required).
- I. Contractor to coordinate with City of Roseburg Public Works Department to shut down signal light at Kenneth Ford Drive at least 36-hours prior to needing signal shut down.
- J. Contractor shall provide temporary asphalt patch at the end of work shift for road cuts into NE Stephens Street. Install of temporary steel plating in roadway may be allowed only where approved by the City.
- K. Required shutdowns of City operated transmission mains, and allowable durations for each shutdown event are included below **in bold in subsection 3.2**. Shutdown durations listed shall include time for City staff to close the necessary valves and drain the line as much as possible through existing blow-offs or fire hydrants, and then refilling and placing existing transmission main back into service after the Contractor's work has been completed.
- L. Contractor shall install new 24-inch water transmission pipeline short of tie-in connections to complete hydrostatic testing and disinfection prior to beginning tie-ins to existing water system. See Section 33 13 00 – Testing and Disinfection of Water Utility Piping.
- M. Contractor and/or Corrosion Engineer/CP Specialist shall test corrosion monitoring system components during install/prior to backfill and record results per requirements of Section 26 42 01 – Corrosion Monitoring System for Ductile Iron Pipe. Final testing will be completed by the Corrosion Engineer or CP Specialist per the Specifications.

3.2 RECOMMENDED SEQUENCE OF CONSTRUCTION REQUIREMENTS AND CONSTRAINTS

- A. 12" Distribution Main Hot Taps - Install hot taps on existing 12" distribution mains in advance of installing connections to new 24" Transmission Main at Kenneth Ford Drive, Costco's South Driveway, Timberlake Street and Isabell Avenue (4 locations).
 - 1. Coordinate with City of Roseburg Water Department regarding scheduling for hot taps at least 1-week prior to performing work to allow for City operations to schedule a City worker to be on standby as required.

2. Allow concrete thrust blocking to cure to design strength prior to pressuring up connection piping, after installing connections, as described below in 3.2B.
- B. Install 24" Transmission Main, Distribution Connections and Appurtenances - Install, pressure test, and disinfect isolated 24" DI transmission main, appurtenances, (including HDD water service replacement), and 12" connections to 12" distribution main hot taps prior to completing final tie-ins to existing 24" DI and 20" steel mains near Hooker Road and Isabell Avenue, respectively.
1. Existing gas distribution pipeline and storm sewer conflicts shown on sheets C-5 and C-6 adjacent to Timberlake Street and Promise Avenue to be mitigated for as shown on drawings prior to installing 24" DI water through these areas.
 2. Trenchless cased crossing underneath dual arch culverts at Davis Creek to be performed in summer months (July, August, or early September) and prior to beginning of the wetter months of the year. Temporarily relocate existing 24" storm drain piping near STA 4+20 as required prior to installation of trenchless launch pit and replace permanently after completion of trenchless crossing work.
- C. Existing 6" Water Crossing at Mobridge Avenue - Isolate existing 6" waterline crossing at Mobridge prior to abandoning existing 20" main. Final abandonment of crossing at Mobridge may be performed as part of this task or after other listed tasks.
- D. Tie-In New 24" Transmission Main – Coordinate with City to shut down and drain existing 20"/24" transmission main, and tie-in and place into service new 24" DI main at either end as shown on drawings. Contractor shall provide notification to Owner in advance of scheduling work and **shutdown of existing 24-inch/20-inch transmission main shall be limited to 10-hours maximum.**
1. Expose and confirm OD of existing 20" Steel Transmission Main at tie-in location south of Isabell Avenue to order flexible couplings prior to performing tie-in.
 2. Tie-in work and pipeline abandonment work located within Hooker Road intersection required to be completed at night.
 3. Swab disinfect each piece of tie-in piping prior to installation and keep piping clean, and excavation dewatered and free of standing ground water during work.
 4. Perform visual inspection for leaks at tie-in pipe joints after pressurizing the 24" pipeline.
 5. Tie-in water meter bank on Hooker Road immediately following placing 24" main into service (same day). Coordinate ahead of time with residences affected by shutdown, and provide bottled water as required.

6. Water service fed off existing 20" main south of project limits at 3791 NE Stephens Street will be out of service during 24"/20" transmission main shutdown. Coordinate ahead of time with residents, and provide bottled water as required during shutdown.
 7. Plug ends of existing 24" and 20" mains adjacent to tie-in locations in preparation for filling and abandoning 20"/24" piping located between Hooker Road and Isabell Avenue in place.
 8. Complete full depth T-cut and final trench patch paving on NE Stephens. Final trench patch paving may be performed later in sequencing as weather and other work scheduling allows.
- E. Install Temporary Feeder to NE Mary Ann Lane - Install above grade temporary HDPE main from existing fire hydrant located off of Jerry's Drive to feed water services along NE Mary Ann Lane prior to shutting down existing 30" Transmission Main and conducting intertie related work.
1. Coordinate with City to obtain Right of Entry from property owner at 4483 NE Stephens Street prior to removing existing fencing and entering property to install above ground, temporary HDPE feeder to NE Mary Ann Lane.
 2. Coordinate scheduling for feeder install with City. City crew will need to install a new fire hydrant along NE Mary Ann Lane prior to Contractor making final connections and placing temporary feeder into service.
 3. Provide surface restoration and replace fencing as required on private property after 30" Transmission Main has been permanently placed back in service as described below in 3.2G.
- F. Install New Transmission Mains Intertie - Coordinate with City to shut down and drain existing 30" Transmission Main after temporary feeder to NE Mary Ann Lane has been put into service, and install New Transmission Mains Intertie. Contractor shall provide notification to Owner in advance of scheduling work and **shutdown of existing 30-inch Transmission Main shall be limited to 14-calendar days maximum.**
1. Use new 24" Transmission Main to supply distribution mains and services within project limits during shutdown of 30", typical.
 2. Expose and confirm OD of existing 30" DI Transmission Main at tie-in locations to order flexible couplings prior to performing tie-in.
 3. Coordinate with Pacific Power and Light to hold nearby utility pole in place as required.

4. Swab disinfect each piece of tie-in piping prior to installation and keep piping clean and trench free of standing ground water during work.
 5. Perform visual inspection to confirm no leaks at pipe joints after re-pressurizing the pipeline. Excavation may be backfilled afterwards.
 6. Allow proper curing for concrete anchor walls prior to placing 30" water back in service.
- G. Abandon Existing Transmission Mains Intertie – Continue shut down of existing 30" water and abandon existing Transmission Mains Intertie located between Hooker Road and Davis Creek.
1. Continue using new 24" Transmission Main to supply distribution mains and services within project limits during shutdown of 30".
 2. Confirm OD of existing 30" DI Transmission Main at tie-in locations to order flexible couplings prior to performing abandonment. OD is anticipated to be the same as measured above in 3.2F.2, but could possibly be different.
 3. Coordinate with Pacific Power and Light to hold nearby utility pole in place during deep excavation work. Existing Intertie piping has approximately 11-feet of cover over the top of it where it is located underneath NE Stephens.
 4. Swab disinfect each piece of tie-in piping prior to installation and keep piping clean and excavation dewatered and free of standing ground water during work.
 5. Perform visual inspection to confirm no leaks at pipe joints after re-pressurizing the pipeline. Excavation may be backfilled afterwards.
- H. Fill and Abandon Existing 20"/24" Piping in Place - Remove pipe caps previously installed, drain remaining water from abandoned piping as required, and fill remaining buried out of service 20"/24" piping between Hooker Road and approximate STA 30+13 with CLSM per the requirements of Specification Section 33 11 50 - Existing Pipe Abandonment.
- I. Final Surface Restoration - Complete final surface restoration items, including 2" cold plane pavement removal and asphalt inlay of south bound lane on NE Stephens.
1. Standard Specifications restrict asphalt concrete paving of wearing course for travel lanes to occur between 3/15 to 9/30. Final surface paving may be allowed outside of this date range if weather, and City, allow.
 2. Permanent grass seeding to be applied prior to October 31st.

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.

1. Mobilization, Bonds, Insurance and Demobilization: Payment for mobilization, bonds, insurance and demobilization 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. Erosion Control: Payment for providing erosion control which shall include: preparing site for construction operations including; removing vegetation, clearing and grubbing the surface within the work limits where required, installation of approved erosion control devices (sediment barrier, inlet protection, check dams, construction entrance, and other items); implementing devices and materials for filtering trench and pit dewatering effluent prior to discharge to prevent migration of sediment off-site; and removal of temporary erosion control devices after construction and establishment of permanent erosion control features; all as shown on Drawings and as required, including all labor, materials, and equipment, as required, will be on a lump sum basis.

Any work relating to erosion control measures required to maintain compliance with local and State of Oregon DEQ regulations shall be considered incidental to this bid item.

3. Traffic Control (Temporary Work Zone Traffic Control and Flaggers, 3a and 3b, respectively): Payment for providing traffic control will be on a lump sum basis, except for payment for traffic flaggers, which will be paid for on an hourly basis. See Specification Section 01 55 26 – Traffic Control.
4. Dewatering, General: Payment for all dewatering required for all work will be made on a lump sum basis and shall include all work required per Section 31 23 19 – Dewatering, including all labor, equipment and materials for dewatering, pumping, onsite storage (as required), and proper disposal of removed water per DEQ requirements. High ground water

was observed during exploratory work and is anticipated in excavations located nearby to Davis Creek, which include deep pit excavations required for the installing 36-inch casing across Davis Creek via trenchless methods, abandoning the existing transmission mains intertie and installation of the new transmission mains intertie, as well as all pipeline trenching in this area.

5. Furnish and Install Restrained 24-inch Class 52 Ductile Iron Pipe with Class B Trench Backfill: Payment for furnishing and installing restrained joint Class 52 ductile iron (DI) pipe with Class B trench backfill, including all work and materials required to perform saw cutting and pavement removal, trench excavation to depth shown on Drawings, spoils removal and disposal, and installation of all required joint restraint system components, standard non-reinforced concrete thrust blocks where specified (including concrete, excavation, and thrust plates), Class B bedding, pipe zone and trench backfill, tracer wire, marking tape, and marker balls, will be on a per linear foot basis. Measurement will be based on total length of piping constructed with restrained joints where specified on the Drawings and as may need to be added due to changes to alignment and/or profile, without deduction for fittings and valves. Bedding, pipe zone and trench backfill material is understood to be imported granular material, compacted in place as shown on the Drawings. Class B material shall be as specified within Section 31 23 17, Trenching.

The pay quantities for pipe, trench excavation and backfill will be on the basis of the horizontal length of pipe laid without deductions for valves or fittings which may be included in the end-to-end measurement of a continuous section of pipe. Where pipe is laid on a continuous slope greater than 10 percent for a distance greater than 100 feet, payment will be made upon the average slope distance between 100-foot stations. When water mains intersect, the measurement of each main shall be to the intersection of the center lines of the connecting fittings.

The unit price shall include any incidental excavation, backfill and additional work required to install branch-line fittings, and also materials to cut and replace existing storm drain piping at crossings to facilitate trench shoring progression where allowed by City and not paid for under other bid items. Install of geomembrane separation material at gas crossings where specified, backfill of trench with CLSM in lieu of Class B trench backfill from STA 1+48 to STA 1+80, and work to pothole locate existing underground utilities where shown on Drawings, shall also be considered incidental.

24-inch ductile iron carrier pipe to be installed inside of 36-inch casing to be paid for under "36-Inch Steel Casing, Trenchless Crossing of Davis Creek Culverts" bid item.

6. Furnish and Install Unrestrained 24-inch Class 52 Ductile Iron Pipe with Class B Trench Backfill: Payment for furnishing and installing unrestrained, push-on style Class 52 ductile iron (DI) pipe with Class B trench backfill, including all work and materials required to perform saw cutting and pavement removal, trench excavation to depth shown on Drawings, spoils removal and disposal, and installation of Class B bedding, pipe zone and trench backfill, tracer wire, marking tape, and marker balls, will be on a per linear foot basis. Measurement

will be based on total length of piping constructed that are not specified on the Drawings to be restrained, without deduction for fittings and valves. Bedding, pipe zone and trench backfill material is understood to be imported granular material, compacted in place as shown on the Drawings. Class B material shall be as specified within Section 31 23 17, Trenching.

The pay quantities for pipe, trench excavation and backfill will be on the basis of the horizontal length of pipe laid without deductions for valves or fittings which may be included in the end-to-end measurement of a continuous section of pipe. Where pipe is laid on a continuous slope greater than 10 percent for a distance greater than 100 feet, payment will be made upon the average slope distance between 100-foot stations. When water mains intersect, the measurement of each main shall be to the intersection of the center lines of the connecting fittings.

The unit price shall include any incidental excavation, backfill and additional work and materials required to cut and replace existing storm drain piping at crossings to facilitate trench shoring progression where allowed by City and not paid for under other bid items. Install of geomembrane separation material at gas crossings where specified, and work to pothole locate existing underground utilities where shown on Drawings, shall also be considered incidental.

7. Furnish and Install Restrained Cast or Ductile Iron Fittings (30-inch, 24-inch, and 20-inch Fittings 7a – 7k): Payment for furnishing and installing cast or ductile iron fittings will be made on a per each basis for the nominal size of the respective fitting installed per the bid schedule. Fitting installation will be considered a separate pay item from work performed under other pay items. Work included under this bid item shall include all labor, materials, and equipment required to furnish and install AWWA C110 or C153 cast or ductile iron fittings with the joint types shown on the Drawings, including joint restraints, Foster Adaptors where specified and as required, wax tape coating, polyethylene encasement, bolts and nuts and other fitting hardware, gaskets, temporary plugs, and any other material required to install fittings in accordance with the Specifications. AWWA C115 ductile iron flange by plain end spools will not be paid for under this bid item and will be paid for elsewhere where described. DI fittings installed on a temporary basis to facilitate testing and disinfection of new water mains to be paid for under other bid items.
8. Furnish and Install Buried 24-inch Gate Valves: Payment for furnishing and installing buried 24-inch gate valves with end connections as specified on the Drawings including valve boxes, covers, risers, operator extensions (where required), wax tape coating and polyethylene encasement, complete, will be on a per each valve basis. All accessories including gaskets, restraint glands, Foster Adaptors, hardware, and all other materials required to install a functional gate valve shall be considered incidental to this bid item.
9. Furnish and Install Buried 24-inch Gate Valves with Bevel Gear Actuator: Payment for furnishing and installing buried 24-inch valves with bevel gear actuator and end connections as specified on Drawings including valve boxes, covers, risers, any additional bedding support

required for installing valve bonnet horizontal, operator extensions (where required), wax tape coating and polyethylene encasement, complete, will be on a per each valve basis. All accessories including gaskets, restraint glands, Foster Adaptors, hardware, and all other materials required to install a functional gate valve shall be considered incidental to this bid item.

Where a FLG x MJ valve is specified on Drawings and this end connection configuration is not produced by valve manufacturer, a gate valve with flanged ends shall be provided with a ductile or cast iron FLG x MJ adaptor (connecting piece) fitting per the requirements of AWWA C110 or C153 to complete the installation as specified. FLG x MJ adaptor fitting and all required hardware, wax tape coating and polyethylene encasement shall be considered incidental to this bid item.

10. Furnish and Install Buried 20-inch Butterfly Valves: Payment for furnishing and installing buried butterfly valves including valve boxes, covers, risers, operator extensions (where required), wax tape coating and polyethylene encasement, complete, will be on a per each valve basis. All accessories including gaskets, restraint glands, hardware, and all other materials required to install a functional butterfly valve shall be considered incidental to this bid item.
11. Furnish and Install Trench Check Dams: Payment for furnishing and installing trench check dams on 24-inch pipe will be on a per each basis. The unit price for this bid item shall include all labor, equipment, and materials required to construct complete trench check dams as shown on the Drawings.
12. Furnish and Install Concrete Anchor Walls: Payment for furnishing and installing concrete anchor walls on 24-inch pipe will be on a per each basis. The per each price for this bid item shall include all labor, equipment, and materials required to construct concrete anchor wall as and where shown on the Drawings. All accessories including concrete, rebar, mechanical joint restraint and steel bearing plate, and all other materials required to construct the anchor wall shall be considered incidental to this bid item.
13. Air Release Valve Assemblies (2-inch): Payment for furnishing and installing 2-inch air release valve assemblies for ductile iron pipe including excavation and shoring, Class B bedding and backfill, PVC tape wrap, and any other items as shown on the Drawings and as specified will be on a per each assembly basis, complete.
14. Air Release Valve Assemblies (3-inch): Payment for furnishing and installing 3-inch air release valve assemblies for ductile iron pipe including excavation and shoring, Class B bedding and backfill, 6-inch and 3-inch piping, fittings, and valves and wax tape coating for buried fittings and valves, polyethylene encasement, precast concrete manhole, air valve vent piping, added shoulder aggregate to revise grading around manhole and any other items as shown on the Drawings and as specified will be on a per each assembly basis, complete. The 24-inch x 6-inch mainline tee fitting shall be paid for under a separate bid item.

15. 6-inch Blow-Off Assemblies: Payment for furnishing and installing 6-inch blowoff assemblies for ductile iron pipe including excavation and shoring, Class B bedding and backfill, 6-inch piping, fittings, and valves and wax tape coating for buried fittings and valves, polyethylene encasement, and any other items as shown on the Drawings and as specified will be on a per each assembly basis, complete. The 24-inch x 6-inch mainline tee fitting shall be paid for under a separate bid item.
16. Fire Hydrant Assemblies: Payment for furnishing and installing fire hydrant assemblies for ductile iron pipe including excavation and shoring, Class B bedding and backfill, 6-inch piping, fittings, and valves and wax tape coating for buried fittings and valves, polyethylene encasement, and any other items as shown on the Drawings and as specified, and any added 6-inch DI bend fittings required to avoid existing utility conflicts will be on a per each assembly basis, complete. The 24-inch x 6-inch mainline tee fitting shall be paid for under a separate bid item.
17. 1" Service Line Connection (North of Timberlake St): Payment for furnishing and installing 1" service line connection from tap on 24-inch Transmission Main pipe at approximate STA 19+32 to existing meter box shown on Drawings will be on a lump assembly basis, complete. Bid item shall include furnishing and installing all materials shown on City standard detail, excluding the water meter (to be furnished by the City) and meter box (existing).
18. 12-Inch Hot Tap on Exist 12" Ductile Iron (at Kenneth Ford Drive, Costco South Entrance, NE Timberlake Street, and NE Isabell Avenue): Payment for furnishing and installing 12-inch hot taps on existing 12-inch ductile iron distribution mains at locations specified shall be on a lump sum basis. Payment for per each bid item shall include all work and materials required to excavate and shore pits for hot tap installation; install 12-Inch x 12-Inch hot tap materials including tapping sleeve, 12" tapping gate valve; water valve box assembly with extension (where required); installation of compacted crushed rock bedding and backfill within the pit; install of wax tape coating and polyethene encasement for tapping sleeve and valve; and install of concrete thrust block. Installation of temporary plating in roadway to avoid backfilling pit prior to installing 12-inch ductile iron connection piping to new 24-inch transmission main, if allowed by city, will be considered incidental to this bid item.
19. 12-Inch Ductile Iron Connection Piping to Hot Tap (at Kenneth Ford Drive, Costco South Entrance, NE Timberlake Street, and NE Isabell Avenue): Payment for furnishing and installing 12-Inch ductile iron connection piping to connect to previously completed hot taps on existing distribution mains at locations specified and shown on Drawings shall include all excavation and shoring, Class B bedding and backfill, 12-inch piping, fittings, flange by plain end spools, and valves and wax tape coating for buried fittings, polyethylene encasement, and any other items as shown on the Drawings and as specified will be on a per each assembly basis, complete. The 24-inch x 12-inch mainline tee fitting shall be paid for under a separate bid item.
20. 36-Inch Steel Casing with 24-Inch Ductile Iron Carrier Pipe; Trenchless Crossing of Davis Creek Culverts: Payment for furnishing and installing 36-inch diameter, 1/2-inch thick steel

casing pipe with restrained joint 24-inch ductile iron main carrier pipe will be on a per linear foot basis and shall include all excavation, excavation support systems and backfill of trenchless launch and receiving pits, furnishing and installing welded casing including grouting of exterior voids, trenchless operations complete including rigging and re-rigging, furnishing and installing 24-inch ductile iron carrier pipe with restrained joints, casing insulators, casing end seal cement grout caps, filling casing with blown clean sand, and all other items for the complete casing installation as shown on the Drawings. Measurement will be based on the total length of casing constructed. Measurement of carrier pipe will be to the ends of the casing. 24-inch ductile iron pipe installed within trenchless launch and receiving pits to be paid for under Bid Item No. 5. Dewatering to be paid for under "Dewatering, General" bid item.

Labor and materials required to demolish and remove existing abandoned-in-place and soil plugged 54-inch by 38-inch arch culverts as required, located in conflict with trenchless launch pit foot print near approximate STA 4+15, as well as any exploratory potholing or test pits required to positively locate and expose abandoned culverts; and to temporarily relocate existing 24-inch storm drain located in conflict with trenchless launch pit near approximate STA 4+20, and replace storm pipe new with like and kind materials shall be considered incidental to this bid item.

21. HDD Water Service Replacement (to Hooker Road): Payment for furnishing and installing HDD water service replacement underneath Central Oregon & Pacific Railroad (COPR) right-of-way to existing water meter bank on Hooker Road, including installing 4-inch HDPE casing approximately to limits shown on Drawings; potholing all crossing underground utilities, as well as obtaining right of entry permit from COPR to access railroad right-of-way for potholing and HDD work as required, prior to conducting HDD; installing 2" water service as shown on Drawings from tap on 24-inch Transmission Main pipe to tie-in at existing water meter bank on Hooker Road and sliplining 2" water service through HDD installed 4" HDPE casing and installing end seals; and capping end of and abandoning existing 2" water service pipe and any other items as shown on the Drawings and as specified will be on a lump sum basis, complete.
22. Testing, Flushing, and Disinfection of Water Mains: Payment for testing, flushing and disinfection of water mains will be on a lump sum basis. New water mains shall be hydrostatically tested, flushed, and properly disinfected separately from existing water facilities prior to completing final tie-in connections. Cost for furnishing, installing and removing temporary blowoff piping including miscellaneous piping, valves, fittings and thrust restraint shall be included in this lump sum. The Owner shall provide off-site laboratory analysis for Bac-T samples. Payment for any retesting shall be paid by the Contractor. Disinfection of connection piping by swab and/or spray prior to tie-in shall be paid for under separate bid items.
23. Connection to Existing 24-inch Ductile Iron Water Transmission Main (STA 1+00 to STA 1+18): Payment for labor and equipment not previously included under other bid items to

install tie-in connection to existing 24-inch Water Transmission Main shall be on a lump sum basis for north end transmission main pipeline connection, complete. Bid item shall also include potholing or exploratory excavation work required to confirm existing piping connections' configuration and requirements, work to properly drain existing piping and dispose of water (where required) and performing swab and/or spray disinfection of connection piping per AWWA C651, all per the requirement of the Specifications. Ductile iron piping and fittings to complete connections to be paid for under their applicable bid items.

24. Connection to Existing 20-inch Steel Water Transmission Main (STA 29+85 to STA 30+53): Payment for labor and equipment not previously included under other bid items to install tie-in connection to existing 20-inch Water Transmission Main shall be on a lump sum basis for south end transmission main pipeline connection, complete. Bid item shall include all work required to furnish and install polyethylene-encased 20-inch diameter restrained joint Class 52 ductile iron (DI) piping with bedding, pipe zone, and trench backfill as per and to limits shown on the Drawings; conduct exploratory excavation work required to confirm existing piping connection configuration and requirements including confirming pipe OD prior to ordering fabricated coupling; work to properly drain existing piping and dispose of water (where required); removal of existing 20" steel piping with coal tar coating; preparing and repairing coating and lining of cut end of steel pipe for tie-in with coupling; protecting existing parallel gas pipeline; and performing swab and/or spray disinfection of connection piping per AWWA C651; all per the requirement of the Specifications. Ductile iron fittings to complete connections to be paid for under their applicable bid items, except for 20-inch insulated flexible reducing or transition coupling (to be determined via exploratory excavation) and wax tape coating, which is to be paid for as part of this lump sum bid item.

It is assumed that coating of existing 20-inch steel piping to be removed contains asbestos. Work to properly remove and dispose of existing piping with coatings containing asbestos to be paid for under "Asbestos Abatement for 20-Inch Pipeline Removal and Abandonment" bid item.

25. Abandonment of Existing 20-Inch Steel/24-Inch Ductile Iron Transmission Main (Fill with CLSM) and 6-inch Water Main at Mobridge Avenue: Payment for filling with CLSM and plugging ends of existing 20-inch/24-inch transmission main piping to be abandoned in place to limits shown on Drawings and per requirements of the Specification, and capping ends of 6-inch water main crossing NE Stephens Street at Mobridge Avenue shall be on a lump sum basis. Lump sum bid item shall include all work and labor required to excavate, expose and cut access holes into existing 20-inch/24-inch pipeline at locations as required; fill existing 20-inch/24-inch pipeline with CLSM via pumping methods per Specifications; plugging ends of pipe and access holes with grout; and backfilling access pits with Class A and Class B material, where located in native and within paved areas, respectively. Surface restoration for access pit areas will be paid for by other bid items.

It is assumed that coating of existing 20-inch steel piping to be cut-into and removed in sections as required contains asbestos. Work to properly cut into, remove and dispose of existing piping with coatings containing asbestos to be paid for under "Asbestos Abatement for 20-Inch Pipeline Removal and Abandonment" bid item.

It is also assumed that existing 6-inch water main to be abandoned in place is asbestos cement (AC) pipe. Remove and dispose of AC pipe, where required, per DEQ standards. See Appendix A in Supplementary Information section for DEQ forms related to AC pipe handling and disposal.

26. Temporary Feeder to Mary Ann Lane: Payment for furnishing and installing above grade temporary feeder water piping connecting an existing fire hydrant located adjacent to NE Jerry's Drive, routed through private property, and connecting to a fire hydrant newly installed by the City located along NE Mary Ann Lane, approximately at the locations and limits shown on the Drawings, to feed distribution piping on NE Mary Ann Lane with water while 30-inch Transmission Main is shut down for intertie work, will be on a lump sum basis. Lump sum bid item shall include all work and materials for butt fusing, laying, providing blocking as required, and testing and disinfecting 4" HDPE piping; completing full size connections to fire hydrants' pumper nozzles including installing transitions required for connecting HDPE pipe to fire hydrant connections; removal and replacement of existing wood fence sections as required; installation of construction fencing around pipe on grade, as well as any other required safety measures; providing temporary fencing as required to secure private property at all times; and removal of temporary feeder after 30-inch Water Transmission Main is placed back in service. Surface restoration, excluding wooden fence replacement as required, shall be included under a separate bid item.
27. New Transmission Mains Intertie: Payment for labor and equipment not included under other bid items to install new transmission mains intertie, as well as items to be furnished and installed as listed herein, complete to limits shown on the Drawings shall be on a lump sum basis. Bid item shall include all work required to furnish and install polyethylene-encased 30-inch and 24-inch diameter restrained joint Class 52 ductile iron (DI) piping with Class B imported crushed rock bedding, pipe zone, and trench backfill where located within roadway prism and Class B bedding and pipe zone and Class A select native backfill elsewhere; conduct exploratory excavation required to confirm existing piping connection configuration and requirements including confirming pipe OD prior to ordering fabricated couplings; properly drain existing piping and dispose of water; adequately shore the excavation and protect existing nearby utility pole; and perform swab and/or spray disinfection of connection piping per AWWA C651, all per the requirement of the Specifications. Ductile iron fittings, valves, concrete anchor walls, and 6-inch blow off assembly included in new intertie piping to be paid for under their applicable bid items, except for 30-inch flexible straight, reducing or transition coupling (to be determined via exploratory excavation) and wax tape coating, which is to be paid for as part of this lump sum bid item.

Work to restore removed pavement and replace existing concrete curb and gutter shall be paid for under Bid Items No. 35 and No. 40, respectively. Work to rebuild edge of road, prior to pavement restoration and concrete curb and gutter replacement, will be paid for as part of this bid item.

28. Abandon Existing Transmission Mains Intertie: Payment for removing existing piping and furnishing and installing 30-Inch ductile iron piping and couplings, as well as capping existing intertie piping, all as shown on Drawings to abandon existing transmission main intertie will be on a lump sum basis. Lump sum bid item shall include all work required to furnish and install polyethylene-encased 30-inch diameter Class 52 ductile iron (DI) piping and flexible straight, reducing or transition coupling (to be determined via exploratory excavation) and wax tape coating with Class B imported crushed rock bedding, pipe zone, and trench backfill per the Drawings; conduct exploratory excavation work required to confirm existing piping connection configuration and requirements including confirming pipe OD prior to ordering fabricated connection couplings; implement excavation support system during deep trench/pit excavation as required to limit disturbance to existing road section and nearby utility pole, gas line, and telephone pedestal; properly drain existing piping and dispose of water; and perform swab and/or spray disinfection of connection piping per AWWA C651; all per the requirement of the Specifications.

Work to restore removed pavement and replace existing concrete curb and gutter shall be paid for under Bid Items No. 35 and No. 40, respectively. Work to rebuild edge of road, prior to pavement restoration and concrete curb and gutter replacement, will be paid for as part of this bid item.

29. Assist Avista to Relocate Gas Lines at STA 20+92 and STA 23+28: Payment for performing trench excavation, trench backfill and restoration work to assist Avista in relocating existing conflicting gas lines at STA 20+92 and STA 23+28 in advance of new 24-inch transmission main install shall be on a lump sum basis. Lump sum pay item shall include coordinating with Avista to determine scheduling and specific needs for assistance, but Class B imported crushed rock material shall be assumed for trench backfill and temporary AC patch shall be installed where trench limits extend into travel lane.
30. Storm Sewer Relocation at STA 21+18: Payment for relocating existing conflicting 12-inch storm sewer in advance of new 24-inch transmission main install at STA 21+18 shall be paid for on a lump sum basis. Lump sum pay item shall include all labor and materials required to excavate and remove existing concrete curb inlet, curb and gutter as required, and storm drain pipe to the extents required to relocate storm facilities out of conflict with new 24-inch water main; furnish and install new concrete curb inlet, curb and gutter, and storm drain piping, including vertical offset and water tight connection to remaining end of existing storm pipe; backfill trench with Class B imported crushed rock backfill and provide temporary AC patch where trench limits extend into travel lane. Concrete curb and gutter replacement and temporary AC patch shall be paid for under other bid items.

31. Ductile Iron Pipe Corrosion Monitoring System: Payment for furnishing and installing a ductile iron corrosion monitoring system on all new ductile iron pipe including insulating joints, joint bonding of pipes, valves and fittings, test stations, system testing, and all other requirements of the Drawings and Specifications, will be made on a lump sum basis, complete.
32. Over Excavation and Trench Foundation Stabilization: Payment for over-excavation of unsuitable trench foundation materials and installation of coarse aggregate backfill material and non-woven geotextile for stabilizing unsuitable foundation conditions per the specifications, will only be considered as approved by the Owner's Representative. When such pre-approval is obtained, payment will be made on a per cubic yard basis.
33. Rock Removal: Payment for rock removal will be made at the unit price per cubic yard of rock removal and rock removal will be paid for in addition to the lineal foot price for pipe, trench excavation and backfill. The pay limits for pipe trench shall be 12 inches below the pipe invert and the width shall be the nominal pipe diameter plus 1 foot on each side of the pipe. Pay limits for vault and other structures shall be to the depth necessary to install the structure and to a maximum of 18 inches beyond the outside walls of the vault or structure. No payment will be made for rock removal beyond these limits.

Rock removal is defined in Section 31 23 18, Rock Removal.

Contractor's attention is directed to Section 01 10 00, Summary of Work, which disallows Contractor's use of explosives.

34. 2-Inch Thick, Temporary Trench Patch Paving (Hot Mix Asphaltic Concrete): Payment for providing temporary trench patch paving on Stephens Street will be made on a per ton basis. Measurement will only be for hot mix asphaltic concrete (HMAC) and install of cold mix asphalt in certain interim situations, when deemed necessary and allowed by City, will be considered incidental to this pay item. Work and materials to maintain temporary trench patch paving until permanent T-Cut trench patch paving can be completed shall also be considered incidental to this pay item.
35. Hot Mix Asphaltic Concrete (HMAC) T-Cut Trench Patch Restoration, Level 3, ½-Inch ACP Mixture: Payment for performing T-Cut trench patch to permanently restore roadway asphalt with new AC paving (ACP), full depth along trenched pipeline alignment, will be measured on a per ton basis of HMAC installed. Work under this item shall include all labor, materials, and equipment required to saw cut and remove and dispose of additional asphalt past trench limits for T-cut; removal and disposal of previously installed temporary trench patch paving and trench backfill to depth of existing AC thickness; furnish and install additional imported crushed rock as required for preparing and leveling road base for permanent paving; furnish and install HMAC in maximum lifts as specified up to 7-inch total thickness minimum or matching existing pavement thickness (whichever is thicker) to restore existing road pavement to the limits determined in the field with the Owner's Representative. Contractor shall restore the existing roadway's width, grades and drainage

to preconstruction conditions. Payment for this bid item shall also include applying tack coat where required and all hauling, screening, placing, and compacting new HMAC, and sand sealing all joints. Adjustment of all valve boxes manhole frames and lids, roadway centerline monuments, and survey benchmarks shall be considered incidental to this bid item.

36. Cold Plane Pavement Removal, 2-Inch Depth - Measurement and payment for cold plane pavement removal shall be on a square yard basis for the depth of grind shown and specified. See Specification Section 32 12 17 – Cold Plane Pavement Removal.
37. Hot Mix Asphaltic Concrete (HMAC) Inlay Wearing Course, Level 3, ½-Inch ACP Mixture, 2-Inch Thick: Measurement and payment for 2-inch thick HMAC inlay shall be on a per ton basis. See Specification Section 32 12 16 – Asphalt Concrete Pavement.
38. Roadway Traffic Loop and Bike Lane Traffic Loop Replacements: Payment for replacing existing roadway traffic loop and bike lane traffic loops shall be on a lump sum basis and shall include all labor, equipment, and materials necessary for the replacement of inductive loop detectors which are impacted as part of work. Items includes saw cutting, furnishing and installing loop wire between the existing junction box and new loops cuts, splicing wire inside the junction box as necessary, removing and replacing the sand pockets as shown, installing new conduit from junction box to sand pocket as shown, testing to confirm that new loops function properly and incidentals as necessary to complete the work as specified.
39. Pavement Markings and Striping: Measurement and payment for the replacement or restoration of existing permanent pavement striping removed, damaged, or otherwise impacted by construction, shall be paid for on a lump sum basis, complete. Restoration of permanent pavement striping and marking shall include the removal of existing damaged markings where required, furnishing and installing of thermoplastic and/or painted markings in accordance with the City's requirements, and other incidental work as required to completely restore existing pavement striping and marking.
40. Concrete Curb and Gutter Replacements: Payment for curb and gutter replacement shall be measured and paid for on a per lineal foot basis. The unit price shall include costs for all labor, materials, tools, equipment, and all incidental work performed. Quantity of replacement lengths paid for under this bid item shall be limited to locations where shown on the Drawings to be replaced only. Any curb and gutter requiring replacement unnecessarily due to incidental damage by Contactor to be replaced and paid for under General Surface Restoration lump sum bid item.
41. Type B Concrete Traffic Separators Replacement: Payment for traffic separator replacement shall be measured and paid for on a per lineal foot basis. The unit price shall include costs for all labor, materials, tools, equipment, and all incidental work performed.
42. Asbestos Abatement for 20-Inch Pipeline Removal and Abandonment: It is assumed that coating of existing 20-inch steel piping to be removed where required and filled with CLSM and abandoned in-place elsewhere, as shown on the Drawings, contains asbestos. Work to

properly expose, cut into and remove and dispose of existing piping with coatings containing asbestos includes but is not limited to; assessment of the site by an accredited asbestos surveyor, application for variances through DEQ, if required, permitting through DEQ, preparation of proper DEQ notification paperwork, removal of friable and non-friable forms of asbestos, all of which shall be considered incidental to this pay item. All work shall be performed by a licensed asbestos abatement Contractor or under the guidance of one as allowed by DEQ, and all disposal shall be performed in accordance with DEQ and OSHA guidelines and Oregon Administrative Rules. It is anticipated that the asbestos encountered will likely become friable during abandoned pipeline excavation and removal if proper precautions are not taken.

43. General Surface Restoration: Payment for general surface restoration including replacement of damaged concrete curb and gutter where not paid for elsewhere, replacement of concrete sidewalk panels where required, stripping and stockpiling topsoil, regrading improved shoulder to original contours, bark mulching planting areas, and cleanup following construction including resurfacing gravel surfaces as required and final reseeding via hydroseeding, and any other final surface restoration work not paid for elsewhere, will be on a lump sum basis, complete.

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section contains administrative and procedural requirements for submittals for review, information, and for Project closeout.
- B. Section includes:
 - 1. Schedule of Submittals.
 - 2. Submittal requirements.
 - 3. Submittal procedures.
 - 4. Engineer review.
 - 5. Resubmittal procedures.
 - 6. Product data.
 - 7. Shop Drawings.
 - 8. Samples.
 - 9. Design data.
 - 10. Test reports.
 - 11. Certificates.
 - 12. Manufacturer's instructions.
 - 13. Manufacturer's field reports.
 - 14. Erection Drawings.
 - 15. Construction progress schedules.
 - 16. Breakdown of contract price.
 - 17. Construction photographs.

1.2 DEFINITIONS

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

1.3 SCHEDULE OF SUBMITTALS

- A. Within 10 days after the Effective Date of the Contract, Contractor shall submit to Engineer a preliminary Schedule of Submittals, including proposed list of major products proposed for use, with specification section reference, 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 submittals and 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 resubmitted when requested by the Engineer.
- D. Contractor's Schedule of Submittals will be acceptable to the Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

1.4 SHOP DRAWING AND SAMPLE SUBMITTAL REQUIREMENTS

- A. Before submitting a Shop Drawing or Sample, Contractor shall have:
 - 1. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - 2. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - 3. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - 4. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- B. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.
- C. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review of each such variation.

1.5 SUBMITTAL PROCEDURES

- A. Contractor shall submit Shop Drawings and Samples to Engineer for review in accordance with the accepted Schedule of Submittals.

- B. Transmit each submittal with Engineer-accepted transmittal form certifying compliance with requirements of Contract Documents.
- C. Sequentially number transmittal forms. Mark transmittal forms for resubmittals with original number and sequential alphabetic suffix.
- D. Show each Submittal with the following numbering and tracking system:
 - 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 used if acceptable to Engineer.
- E. Identify: Project, Contractor, subcontractor and supplier, pertinent drawing and detail number, and specification Section number appropriate to submittal.
- F. 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.
- 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, six (6) copies of all materials shall be provided to the Engineer. Two (2) copies of reviewed submittals will be kept by the Engineer, two (2) copies of reviewed submittals will be transmitted to the Owner, and two (2) copies of reviewed submittals will be returned to the Contractor. If the Contractor requests that more than two (2) copies of the reviewed

submittal be returned, then the Contractor shall submit the appropriate quantity of submittals.

- I. When electronic transmittals of submittals are provided by the Contractor under established protocols described elsewhere in the Contract Documents or as jointly developed by the Owner, Engineer and Contractor, provide electronic submittals in portable document format (PDF) in addition to the source document format (Word, Excel, AutoCAD, etc.). Reviewed submittals will be returned to the Contractor as PDF electronic files.
- J. For each submittal for review, allow not less than fourteen (14) days for Engineer review, excluding delivery time to and from Contractor.
- K. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.
- L. Allow space on submittals for Contractor and Engineer review stamps or comments.
- M. 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.
- N. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with review comments.
- O. Submittals not requested will not be recognized nor processed.
- P. 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 CONTRACTOR REVIEW

- A. Review for compliance with Contract Document and approve submittals before transmitting to Engineer.
- B. Contractor shall be 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.

1.7 ENGINEER REVIEW

- A. 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.
- B. 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.
- C. Submittals made by Contractor that are not required by Contract Documents may be returned without action.
- D. 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".

- E. If more than two (2) submissions of an item are required to meet the Project specifications, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.
- F. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
- G. Engineer's review will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
- H. Engineer's review of a separate item as such will not indicate approval of the assembly in which the item functions.
- I. Engineer's review of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 1.4.C and Engineer has given written acceptance of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such accepted variation from the requirements of the Contract Documents in a Field Order.
- J. Engineer's review of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 1.4 A. and B.
- K. Engineer's review of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
- L. Neither Engineer's receipt, review, return of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.
- M. Contractor shall perform the Work in compliance with the requirements and commitments set forth in returned Shop Drawings and Samples, subject to the provisions of Paragraph 1.6.I.

1.8 RESUBMITTAL PROCEDURES

- A. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples

for review. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

- B. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required review of an item with no more than two submittals. Engineer will record Engineer's time for reviewing a third or subsequent submittal of a Shop Drawings, sample, or other item requiring review, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
- C. If Contractor requests a change of a previously reviewed submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

PART 2 PRODUCTS

2.1 CONSTRUCTION PROGRESS SCHEDULES

- A. Within ten (10) days after the Effective Date of the Contract, 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. A time-scaled bar chart schedule shall include the following:
 - Construction activities
 - Submittal and review of critical material samples and shop drawings
 - Procurement and delivery of critical materials
 - Duration of work, including completion times of all stages and their sub-phases
- 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 **four (4)** 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 BREAKDOWN OF CONTRACT PRICE

- A. Within ten (10) days after the Effective Date of the Contract, 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.

2.3 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 Paragraph 1.5.M and for record documents.

2.4 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. 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.
- E. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.5 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 Paragraph 1.5.M and for record documents.

2.6 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.

2.7 TEST REPORTS

- A. Informational Submittal: Submit reports for Engineer's knowledge and records as Contract administrator or for Owner.
- B. Submit test reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

2.8 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.

2.9 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.

2.10 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.

2.11 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.

2.12 CONSTRUCTION PHOTOGRAPHS

- A. Provide photographs of Site and construction throughout progress of Work.
- B. Each month submit photographs with Application for Payment.
- C. Photographs: Electronic, PDF or JPEG format.
- D. Take two Site photographs from different directions indicating relative progress of the Work, five days maximum before submitting.
- E. Identify each photo in the electronic file name. Identify name of Project, phase, orientation of view, date and time of view.
- F. Digital Images: Deliver complete set of digital image electronic files on CD-ROM (or via internet) to Owner with Project record documents. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as sensor, uncropped.
 - 1. Digital Images: Uncompressed TIFF format, produced by digital camera with minimum sensor size of 4.0 megapixels, and image resolution of not less than 1600 by 1200 pixels.
 - 2. Date and Time: Include date and time in filename for each image.

2.13 OTHER REQUIRED SUBMITTALS

- A. Other required submittals include the items listed below. This list is provided for Contractor's convenience only and may not be complete in all respects. Contractor shall provide all submittals specified or required, whether or not listed here.
 - 1. Contractor Emergency Contact List.
 - 2. Erosion and Sediment Control Plan.
 - 3. Traffic Control and Protection Plan.
 - 4. Record Drawings.

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 Testing	Minimum Testing Frequency
Trench Backfill	CONTRACTOR	In-place compaction testing (w/ nuclear compaction gage) performed at 2-foot elevation increments, one test per 200 lineal feet of pipeline trench as measured along pipe centerline. ENGINEER may reduce frequency to one test per lift for every 1,500 lineal 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	CONTRACTOR	As required when placed. See detailed requirements in Article 3.12, Concrete Tests of Section 03 11 00, Concrete Work.
Waterline – Hydrostatic testing	CONTRACTOR	As required. See Section 33 13 00, Testing & Disinfection of Water Utility Piping.
Waterline - Disinfection	CONTRACTOR	As required. See Section 33 13 00, Testing and Disinfection of Water Utility Piping. Contractor to coordinate with Owner to collect Bac-T samples, and Owner to take custody of samples for delivery to lab for coliform testing. Contractor to pay all lab fees for testing as required.

END OF SECTION

SECTION 01 55 26 - TRAFFIC CONTROL

PART 1 GENERAL

1.1 SUMMARY

- A. Comply with the ODOT 2018 Oregon Standard Specifications for Construction modified as shown in this section.
- B. Comply with Section 00110 of the Oregon Standard Specifications, modified as follows:

00110.20 Definitions - Replace the definition for "Engineer" with the following:

Engineer – the Engineer refers to the Owner's Representative

1.2 SUBMITTALS

- A. Submit items listed below in accordance with Section 01 33 00.
- B. Traffic Access Plan:
 - 1. Prepare a Traffic Access Plan and submit it to Owners fifteen (15) days before start of construction.
 - a. Define public roadways identified by the Contractor as access or haul routes. The routes identified shall specifically detail the requirements for controlling traffic through the project, including any additional flagging or safety control requirements.
 - b. Traffic Access Plan shall indicate the access required, including the type of equipment operating on public roadways, the expected access days and times, and the associated Traffic Control proposed.

Traffic Access Plan shall identify appropriate treatment of all significant hazards likely to be encountered during the project.

00220 – ACCOMMODATIONS FOR PUBLIC TRAFFIC

Comply with Section 00220 of the Standard Specifications modified as follows:

00220.02(a) General Requirements - Add the following bullets to the end of the bullet list:

- When performing trench excavation or other excavation across or adjacent to a Traffic Lane on a roadway having a pre-construction posted speed greater than 35 mph, backfill the excavation, install asphalt surfacing, and open the roadway to traffic by the end of each work shift. Install a "BUMP" (W8-1-48) sign approximately 100 feet before the backfilled area and

a "ROUGH ROAD" (W8-8-48) sign approximately 500 feet ahead of the "BUMP" sign. If this requirement is not met, maintain all necessary lane or shoulder closures and provide additional TCM, including flagging, at no additional cost to the Agency. Do not use temporary steel plating to reopen the roadway.

- When an abrupt edge is created by excavation, protect traffic according to the "Excavation Abrupt Edge" and the "Typical Abrupt Edge Delineation" configurations shown on the Standard Drawings.

00220.03 Work Zone Notifications - Add the following bullet to the end of the sub-section:

(c) Permitting and Public Notification - Obtain a City of Roseburg Street Closure Permit for all lane, shoulder or sidewalk closures prior to closing. Obtain permit at least 7 days in advance of actual closure.

- The City will provide general notification through the news media of the scope of the project. However, the Contractor shall provide a minimum of seven days' notice to each property owner who is affected by the temporary interruption of their access, one way restrictions, detours, temporary road closures, restricted parking, etc. It shall be the Contractor's responsibility to provide written and verbal notice to each property owner, resident, or business manager whose access is restricted or limited.
- It shall be the Contractor's responsibility to contact all emergency responding facilities such as, but not limited to, City police, City fire department and ambulance services before any one way or detour routes are established.

00220.40(e)(1) Closed Lanes - Replace this subsection, except for the subsection number and title, with the following:

NE Stephens Street - Station 1+00 to 3+50 and Station 4+25 to Station 11+50:

One Traffic Lane and the median may be closed on NE Stephens Street between Station 1+00 to 3+50 and Station 4+25 to Station 10+50 when allowed, shown, or directed during the following periods of time except as indicated in 00220.40(e)(2). Maintain a minimum of one lane of traffic with flaggers.

- Nightly, Sunday evening through Friday morning between 7:00 p.m. and 7:00 a.m.

NE Stephens Street - Station 11+50 to Station 30+00:

One Traffic Lane and the median may be closed on NE Stephens Street between Station 10+50 and Station 30+00 when allowed, shown, or directed during the following periods of time except as indicated in 00220.40(e)(2). Maintain a minimum of one lane of traffic with flaggers.

- Daily, Monday through Friday between 7:00 a.m. and 7:00 p.m.

NE Stephens Street - Davis Creek Trenchless Crossing (Station 3+50 to 4+25):

Maintain one Traffic Lane in each direction on NE Stephens Street between Station 3+50 and Station 4+25 during the Davis Creek Trenchless Crossing work, as shown.

00220.40(e)(2)(b) Special Events - Add the following to the end of this subsection:

The following special events will occur during this Project:

- Graffiti Weekend – July 7th – July 11th
- Douglas County Fair – August 3rd – August 7th

SECTION 00225 - WORK ZONE TRAFFIC CONTROL

Comply with Section 00225 of the Standard Specifications modified as follows:

00225.01(b) Definitions – Add the following to the end of the subsection:

Temporary Walk – Temporary Surfacing for a sidewalk or Multi-Use Path designated to be used by pedestrians, bicyclists, or other non-motorized users.

00225.02(a) Temporary Signs - Add the following bullet(s) to the end of the bullet list:

- Install "ROAD WORK AHEAD" (W20-1-48) signs with a 36 by 24-inch "FINES DOUBLE" (R2-6aP) rider on NE Stephens Street, according to the "TCD Spacing Table" shown on the Standard Drawings or as modified by the Plans except do not install the "FINES DOUBLE" rider on barrier mounted signs.
- Install beyond each end of the Project, facing outgoing traffic, an "END ROAD WORK" (CG20-2A-24) sign a distance of $(A \div 2)$ according to the "TCD Spacing Table" shown on the Standard Drawings or as modified by the Plans.
- When construction requires bicycles to use the Traffic Lanes, install a "Bicycle ON ROADWAY" (CW11-1) symbol sign on 1/2 mile spacing through the affected area. Keep the signs in place until completion of the Shoulder or bikeway final surface.

00225.12(c) Concrete Barrier and Appurtenances - Replace the title of this subsection with "Barrier and Appurtenances"

Add the following to the end of the subsection:

Use a temporary barrier or minimum deflection temporary barrier from the QPL or Concrete Barrier as follows:

00225.13(e)(2) Concrete Barrier - Replace this subsection with the following subsection:

00225.13(e)(2) Temporary Barrier - At temporary barrier locations, use Type 5 delineators.

00225.14(a) Flagger Station Lighting - Add the following bullet to the end of the bullet list:

- In addition to the products listed on the QPL, tripod mounted or cart mounted flagger station lights that were purchased on or before January 1, 2014 and that were on the QPL before January 1, 2014 may also be used. Provide proof of the original purchase date to the Engineer.

00225.32(b) Traffic Control Inspection Without TCS - Add the following bullet to the end of the bullet list:

- Shall report to the Project Site within 1 hour after being notified in the event of a Work Zone incident during non-work periods.

00225.42(c) Concrete Barrier and Appurtenances - Replace the title of this subsection with “Temporary Barrier and Appurtenances”

00225.42(c)(1) Concrete Barrier - Replace this subsection with the following subsection:

00225.42(c)(1) Temporary Barrier - Connect all temporary barrier sections together according to the following:

- Concrete Barrier per the Standard Drawings
- Temporary Barrier per manufacturer’s recommendations.

When placing barrier adjacent to a Traffic Lane, maintain a minimum of 24 inches from the face of the barrier to the edge of the Traffic Lane, or as shown or directed. Flare the leading end as shown in the table below and treat ends as shown on the Plans.

Speed (mph)	Flare Rate
70	20:1
65	19:1
60	18:1
55	16:1
50	14:1
45	12:1
40	10:1
35	9:1
< 30	8:1

Secure temporary barrier to bridge decks according to the ODOT Bridge Design Manual or as shown.

Keep the 3 feet of space behind temporary barrier clear. Keep 1 foot of space behind minimum deflection temporary barrier, clear. Secure concrete barrier used for minimum deflection to Surfacing according to the Standard Drawings. Secure all other temporary barriers to Surfacing according to the manufacturer’s recommendations.

When the clear area distance behind the barrier is less than 3 feet, use minimum deflection temporary barrier.

Place temporary barrier and minimum deflection temporary barrier on smooth, solid surfacing. Maintain smooth, solid surfacing for the clear area behind temporary barrier.

00225.42(d) Impact Attenuators - Add the following bullet and sub-bullets to the end of the bullet list:

- For water-filled impact attenuators, use one of the following anti-freezing solutions to fill the impact attenuator:
- 25% Liquid Calcium Magnesium Acetate (CMA), 75% water solution, by volume
- 60% Liquid Potassium Acetate, 40% water solution, by volume

00225.43(d) Delineators - Replace the paragraph that begins " Install traffic delineators as shown or as directed. Install..." with the following paragraph:

Install traffic delineators as shown or as directed. Install delineators on temporary barrier and temporary guardrail as follows:

00225.46(b) Portable Changeable Message Signs (PCMS) - Add the following bullets to the end of the bullet list:

- Type B, Mini PCMS use is limited to locations where the preconstruction posted speed is 40 mph or less.

00225.62(a) Temporary Concrete Barrier and Guardrail - Replace the title of this subsection with "Temporary Barrier and Guardrail"

Replace the sentence that begins "Immediately repair any concrete barrier segment..." with the following paragraph:

Immediately repair any temporary barrier segment or guardrail element that is damaged by the Contractor during or after placement.

00225.82(b) Guardrail and Concrete Barrier - Replace the title of this subsection with "Guardrail and Temporary Barrier"

00225.82(b)(3) Concrete Barrier - Replace this subsection with the following subsection:

00225.82(b)(3) Temporary Barrier - No measurement will be made for temporary barrier.

The estimated quantity of temporary barrier is:

Stage/Phase	Location	Temporary Barrier	Minimum Deflection, Temporary Barrier
Davis Creek Trenchless Crossing	Station 2+50 to 5+25	280 feet	

00225.84(a) Flagger Station Lighting - Replace this subsection, except for the subsection number and title, with the following:

No measurement will be made for flagger station lighting.

00225.88(b) Traffic Control Supervisor - Delete this subsection. No separate measurement will be made for the traffic control supervisor.

00225.90 (b) Method "B" – Lump Sum Basis - replace this subsection with the following:

Except for flaggers, work zone traffic control will be paid at the Contract lump sum amount for the following pay item:

Pay Item	Unit of Measurement
(a) Temporary Work Zone Traffic Control	LS

Payment for flaggers will be according to 00225.98

Payment will be payment in full for furnishing, installing, moving, operating, maintaining, inspecting, and removing materials and TCD, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

END OF SECTION

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes provisions for temporary protection of trees and other plant life in preparation for site Work.
- B. Related Sections:
 - 1. Section 31 10 00 - Site Clearing.
 - 2. Section 31 22 13 - Rough Grading.
 - 3. Section 31 23 16 - Excavation.
 - 4. Section 31 23 17 - Trenching.
- C. This specification shall be applied concurrently and in conjunction with other plant material protection measures herein described and specified.

PART 2 MATERIALS - Not Used

PART 3 EXECUTION

3.1 INSPECTION

- A. Inspect all trees specified on the Drawings for protection prior to construction.
 - 1. Document with written memorandum and photographs any unusual conditions.
 - 2. Submit copies of documentation to ENGINEER prior to beginning work.
- B. Verify all conditions on the Drawings with actual conditions at Site regarding tree protection prior to any site disturbance.
- C. The ENGINEER must be present during demolition of existing conditions occurring within the drip line of trees designated to remain.
- D. Notify ENGINEER 24 hours prior to inspections and/or tagging of protected trees.

3.2 PROTECTION

- A. Install barricades specified in the Drawings at drip lines of trees designated to remain prior to the commencement of construction.

- B. Clearly designate protected trees and clear of any material storage, personnel, or vehicular movement.
- C. Provide temporary fencing, barricades, and guards as necessary or required to protect trees designated on the Drawings to remain, from damage above and below grade.
- D. Protect root systems of trees and plant life to remain.
 - 1. Protect from damage due to noxious materials in solution caused by runoff or spillage during mixing and placement of construction materials.
 - 2. Protect from flooding, erosion, or excessive wetting resulting from dewatering operations and compaction.
 - 3. Protect against unauthorized cutting, breaking, skinning roots and branches, or bruising bark.
 - 4. Protect from smothering and compaction.
 - a. Do not store construction materials or permit vehicles to drive or park within the drip line area of any tree to remain.
 - 5. Protect from dumping of refuse in close proximity.
- E. Where cutting is necessary, review conditions with the ENGINEER before proceeding, and comply with directives of ENGINEER.

3.3 EXCAVATION AROUND TREES

- A. Excavate within drip lines of trees only where indicated on the Drawings or as directed by ENGINEER.
- B. Where trenching for utilities is required within drip lines, tunnel under or around roots by hand excavating.
 - 1. Where possible trench toward trunk of tree and tunnel under central root mass to avoid severing all lateral roots on side of trench.
 - 2. Do not cut main lateral roots or tap roots over one inch in diameter.
 - 3. Temporarily support and protect trees from damage until permanently covered with approved backfill.
- C. Do not allow exposed roots to dry out before backfill is placed.
 - 1. Provide temporary earth or burlap cover.

2. Water roots daily when exposed and maintain in a moist condition.
- D. Backfill roots only upon inspection approval from the ENGINEER.
1. Backfill around root excavations only with clean imported topsoil free from materials deleterious to root growth.
 2. Backfill to eliminate voids and compact only by means of manual tamping at root areas.
 3. Water sufficiently to settle topsoil and eliminate voids or air pockets around roots.
 4. Allow for natural settlement of soil surface, and furnish and apply topsoil sufficient to bring to original finish grade after backfill settlement.
- E. If during excavation, any condition arises that threatens the survivability of the protected tree, or an unknown condition arises that affects the stability or integrity of the root system, notify the ENGINEER immediately.

3.4 REPAIR AND REPLACEMENT OF DAMAGED TREES

- A. In the event of damage to existing trees:
1. Immediately prune limbs smaller than 3" caliper or roots smaller than 2" caliper to repair trees damaged by construction operations.
 2. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees.
 3. Any such pruning and/or repairs shall be approved in advance and at completion by ENGINEER.
 4. The ENGINEER shall reserve the right, at cost to the CONTRACTOR, to obtain the services of a Certified Consulting Arborist with current membership in the American Society of Consulting Arborists to determine the severity of damage.
 5. The CONTRACTOR is responsible for the cost of repairs caused by their actions or by the actions of subcontractors engaged by the CONTRACTOR.
- B. Remove and replace dead or damaged trees which are determined by the ENGINEER to be incapable of restoration to normal growth patterns at no additional cost to OWNER.
1. Provide new trees of the same species as those removed or damaged, with size and/or quantity to be determined by ENGINEER.

2. Furnish replacement trees and plant life to the Site and plant, maintain, and warranty as directed by the ENGINEER.
3. If trees are not replaceable with the same species, and size, compensate the OWNER for the replacement cost of the trees based on the evaluation of a Certified Consulting Arborist.
4. The CONTRACTOR is responsible for additional costs of removing damaged trees and labor for planting new specimens.

3.5 DESIGNATED TREE REMOVAL PROCEDURES

- A. If designated tree removal is specified by ENGINEER, furnish labor, material, and equipment necessary for removing and/or salvaging existing trees, if necessary, as designated on the Drawings for removal.
 1. Verify location and species with ENGINEER prior to removal.
- B. Salable logs or timber may be sold to CONTRACTOR's benefit upon notification and prior approval of OWNER, unless otherwise shown on Drawings. Upon approval, remove salable logs or timber promptly from site.

3.6 DESIGNATED TREE TRANSPLANTING PROCEDURES

- A. If designated tree transplanting is specified by ENGINEER, verify and identify existing trees to be transplanted.
- B. All work shall be in accordance with the standards and practices outlined in the following: Tree and Shrub Transplanting Manual, E.B. Himelick, 1981 Ed., International Society of Arboriculture.
- C. Prior to commencement of Work, submit a coordination schedule, method of transplanting, traffic control, routing, etc., to ENGINEER, for review and approval.
- D. Warranty for transplanted trees shall be determined and directed on a case by case basis by the ENGINEER, upon contracting of specified transplanting work.
- E. Review and verify location of utilities in area of operation. Obtain location and jurisdictional approval from utilities prior to transplanting activities. Protect utilities and the public at all times.
- F. Prior to transplanting, spray trees with an anti-desiccant emulsion-type film forming agent, "Dowax" by Dow Chemical Company, "Wilt-Pruf" by Nursery Specialty Products Inc., "D-Wax", by Plant Products Inc., or approved equal, prior to digging with two separate applications allowing 48 hours apart. Use a power sprayer to provide an

adequate film over trunks, branches, stems, twigs, and foliage. Anti-desiccant must be dry prior to relocation.

- G. Dig, ball and burlap, and move designated trees for relocation to the new planting location shown on the Drawings. In the event the new planting area is not prepared, place tree in a storage area approved by the ENGINEER solely designated for healing-in of plant materials until final planting may occur. Brace in a vertical position, provide shade, wind protection, and irrigation at plant storage area. Utilize all horticulturally proper methods for plant storage. Plants shall be maintained by CONTRACTOR while in storage.

3.7 GRADING AND FILLING AROUND TREES

- A. Maintain existing grade within drip line of trees unless otherwise indicated on the Drawings or directed by the ENGINEER.

3.8 MAINTENANCE OF PROTECTIVE MEASURES

- A. Maintain protective measures throughout the construction process. Immediately repair any alteration to protection measures throughout construction process. Repair or reinstall protective measures immediately upon alteration. Monitor protective measures daily.
- B. Remove and clear area of debris and fencing, barricades, etc., upon final written approval of ENGINEER.

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 13 of the Information 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 02 41 00 - DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of existing facilities.
2. Abandoning and removing utilities.

B. Related Sections:

1. Section 31 05 16 - Aggregates for Earthwork.
2. Section 31 10 00 - Site Clearing.
3. Section 31 22 13 - Rough Grading.
4. Section 31 23 16 - Excavation.
5. Section 33 11 50 - Existing Pipe Abandonment.

- C. See Section 33 11 50 – Existing Pipe Abandonment, for asbestos abatement requirements for removal of and filling with CLSM and abandonment of 20-inch pipeline with coating that contains asbestos.

1.2 SUBMITTALS

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

- B. Submit to Engineer 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.

1.3 QUALITY ASSURANCE

- A. Existing Conditions: Determine the extent of work required and limitations before proceeding with Work.

- B. Conform to applicable local, state and federal codes for environmental requirements in relation to disposal of debris.

1. Burning at the Site for the disposal of refuse, debris, and waste materials resulting from demolition and site clearing operations shall not be permitted.

- C. Permits: The Contractor is responsible for obtaining all necessary permits required for completion of the Work described in this Section.

- D. 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.
- E. If the existing material to be demolished and removed contains any hazardous materials which will require special handling upon removal, such as asbestos or lead, 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 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. Crushed Rock: As specified in Section 31 05 16-2.1, Aggregates for Earthwork. Of the size shown in the Drawings or specified herein.
- C. Sand: As specified in Section 31 05 16-2.2, Aggregates for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

- A. The Owner assumes no responsibility for the actual condition of the facilities to be demolished. The Contractor shall visit the site, inspect all facilities and be familiar with all existing conditions and utilities.
- B. Demolition drawings identify major equipment and structures to be demolished only. Auxiliary utilities such as water, air, chemicals, drainage, lubrication oil, hydraulic power fluid, electrical wiring, controls, and instrumentation are not necessarily shown shall be considered incidental to all demolition work.
- C. Identify waste and salvage areas for placing removed materials.

3.2 PREPARATION

- A. Carefully coordinate the work of this Section with all other work and construction.
- B. Call Local Utility Line Information service at the telephone number listed below, not less than three working days before performing Work.

C. 1-800-332-2344, Oregon

1. Request underground utilities to be located and marked within and surrounding construction areas.
2. Disconnect or arrange for disconnection of utilities (if any) affected by required work.
3. Keep all active utilities intact and in continuous operations.

3.3 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: As specified in Section 31 10 00-3.4.C, Site Clearing.
- D. Landscaped Areas: Protect existing landscaped areas as specified in Section 31 10 00-3.4.D, Site Clearing.
- 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, guy wires, utility poles, 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.

3.4 DEMOLITION

- A. Areas which are to be excavated for the purpose of demolition shall be cleared and stripped in accordance with Section 31 10 00-3.6, Clearing and Grubbing.
- B. Carefully consider all bearing loads and capacities for placement of equipment and material on site. In the event of any questions as to whether an area to be loaded has

adequate bearing capacity, consult with Engineer prior to the placement of such equipment or material.

C. Demolition of Existing Structures:

1. Excavate around existing structures as required to perform demolition operations and to plug associated existing pipelines where shown in the Drawing.
2. Provide shoring, bracing, and supports, as required, to insure adjacent structures are not damaged and structural elements of existing structure are not overloaded during demolition activities.
 - a. Increase structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this Contract.
 - b. Remove all temporary protection when the Work is complete or when so authorized by the Engineer.
3. Any floors that are to remain in place shall be completely cracked through to allow for drainage. Cracking shall be accomplished by dropping a demolition ball or by other methods approved by the Engineer.
4. Remove and dispose of all exposed and/or protruding metalwork, piping, plumbing and conduits resulting from demolition activities, and all woodwork, roofing, and electrical and mechanical equipment removed from demolished structures.
 - a. Reinforcing bars shall be cut flush with final wall elevations as shown in the Drawings.
 - b. No detached metalwork, excluding concrete reinforcing bars, shall be buried with the concrete and masonry rubble.

D. Backfill at Demolished Structures:

1. For structures designated to be abandoned and/or demolished in place, concrete and/or masonry rubble and excavated soils resulting from demolition activities shall be used for backfill or placed in the bottoms of said structures only as directed by the Engineer.
2. Concrete and masonry rubble used for backfilling shall be broken into pieces no larger than 12 inches on any one side.
3. Materials resulting from abandonment / demolition activities approved for backfill shall be combined with imported filler sand to create a dense, compacted backfill.

4. Backfilling or placement of the excavated material in the structures shall meet the following requirements.
 - a. Furnish, place and compact filler sand along with the concrete and masonry rubble so that all voids are filled and a dense, compacted backfill is obtained.
 - b. Filler sand shall be placed in horizontal layers completely filling all voids between pieces of rubble and not exceeding 12 inches in thickness.
 - c. Each layer of filler sand shall be compacted to obtain at least 90 percent of maximum density as determined by ASTM Method D-698-78 (AASHTO T-99).
 - d. Water shall be furnished by the Contractor and added to each layer as required to maintain optimum moisture content.
 - e. The amount of filler sand used shall only be the amount needed to fill all voids created by placement of the concrete and asphalt rubble, as directed by the Engineer.
 - f. At locations where concrete and masonry rubble is used for backfill, it shall be placed such that a minimum of 3 feet of compacted non-rubble backfill material (crushed rock) exists between any rubble and finished grade. Protruding reinforcing bars shall be cut to lengths that allow granular backfill to be placed and compacted to required levels in and above the rubble.
5. Disposal of all materials not used for backfill shall be performed off-site and in compliance with applicable local, state, and federal codes and requirements.
6. In areas where new construction will take place, no trace of these structures shall remain prior to placing of backfill.
- E. Backfilling within the footprint of new structures with rubble material resulting from demolition activities will not be allowed.
- F. All existing improvements designated in 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 demolition work.
- G. Unless otherwise specified, any resulting voids shall be backfilled with suitable excavated or imported material compacted to the density of the adjacent soil.

3.5 EXISTING WATER UTILITY PIPING ABANDONMENT

- A. As specified in Section 31 11 50, Existing Pipe Abandonment.

3.6 ASPHALTIC CONCRETE DEMOLITION

- A. Asphalt pavement shall be removed to the limits shown in the Drawings.
- B. The limits of the removal shall be saw cut.
- C. Asphalt pavement may not be used as rubble fill.

3.7 REMOVAL

- A. Remove debris, rock, excavated materials, rubble, abandoned piping and extracted plant life resulting from abandonment and/or demolition activities from site.
- B. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.
- C. Removal: All material resulting from demolition, clearing and grubbing, and trimming operations shall be removed from the project site and disposed of in a lawful manner. Materials placed on property of private property owners shall be by written permission only.

3.8 GRADING

- A. All grading work shall be completed in accordance with Section 31 22 13, Rough Grading.

3.9 CLEANUP:

- A. During and upon completion of work, promptly remove all unused tools and equipment, surplus materials, debris, and dust and shall leave all areas affected by the work in a clean, condition, as may be subject to Engineer approval.
- B. Adjacent structures shall be cleaned of dust, dirt and debris resulting from demolition.
- C. Adjacent areas shall be returned to their existing condition prior to the start of work.

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 CONTRACTOR will engage a special inspector/testing laboratory to perform material evaluation tests. 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 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 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 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.

2.3 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. 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.

2.4 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)
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All other Uses	Grade 60
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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, $\frac{3}{4}$ "-inch, manufactured from 100% virgin homopolymer polypropylene, hydrophobic, in compliance with ASTM C116.

2.5 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 ($\frac{1}{5}$) of the narrowest dimensions between sides of forms, one-third ($\frac{1}{3}$) of the depth of slabs, nor three-fourths ($\frac{3}{4}$) 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.

2.6 RELATED MATERIALS

A. 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.

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

C. 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.

D. 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.

E. 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.

F. 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.

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

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

2.7 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

Notwithstanding 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 4,000 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 cementitious 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.

2.8 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. 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.
- G. 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.
- H. 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.
- I. 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.

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. 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.

F. 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.

G. 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. 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 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.

3.9 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.

3.10 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.

3.11 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 loose 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 loose 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.

3.12 QUALITY CONTROL TESTING DURING CONSTRUCTION

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

- 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 26 42 01 - CORROSION MONITORING SYSTEM FOR DUCTILE IRON PIPE

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section covers the work necessary to furnish and install a corrosion monitoring system on buried ductile iron water pipelines and appurtenances complete, including pipeline isolation joints (insulated flanges and couplings), bonds on the pipeline, valves and fittings between isolation joints to form an electrically continuous pipeline, and corrosion monitoring test stations.
- B. The CONTRACTOR shall furnish all labor, equipment and materials as required for the complete installation of the corrosion monitoring system and cathodic protection specified herein. The corrosion monitoring system shall include the appropriate pipe bonding, fitting bonding, backfill material, test stations, cables, fittings and all necessary items of equipment and materials for the completed system. It is the intent of these Specifications that the CONTRACTOR furnish and install all materials and equipment and provide all labor required and necessary to complete the work shown on the drawings or specified herein and elsewhere, and all other work items not specifically mentioned but reasonably inferred for a complete installation.

1.2 GENERAL

Like items of materials provided hereunder shall be the end product of one manufacturer to achieve standardization for appearance, maintenance, and replacement.

1.3 DEFINITIONS

- A. Ferrous Metal Pipe/Fitting: Any pipe and/or fitting made of steel or iron and pipe containing steel or iron as a principle structural material, except reinforced concrete.
- B. Lead, Lead Wires, Fitting Bonds, Cable: Insulated copper conductor; the same as wire.
- C. AWG American Wire Gauge
- D. NACE National Association of Corrosion Engineers (NACE International)

1.4 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall submit for approval the following items:
 - 1. A complete list of equipment and material to be furnished, including name and manufacturer, catalog number, size, finish and other pertinent data necessary for proper identification and to determine conformance with Specifications.
 - 2. Certification by the cable manufacturer-covering conformance of cable insulation to designated specification.
 - 3. Thermite welder's certification. See Item 1.5.F of this Section.
 - 4. Joint bond tester's certification. This is the person that performs the test prior to burial, see Item 1.5.F of this Section. The Corrosion Engineer or Cathodic Protection Specialist must perform the test after burial.
 - 5. Resume for Corrosion Engineer or Cathodic Protection Specialist.
 - 6. Test plan to be used to verify electrical continuity of piping network. OWNER approval of the test plan is required prior to performing field testing.
- B. Upon completion of the corrosion monitoring system, and as a condition of its acceptance, deliver, for use by the OWNER and ENGINEER, four complete bound sets of the following information:
 - 1. Components of corrosion monitoring system, including copies of all product data and list of corrosion monitoring equipment suppliers with addresses and phone numbers;
 - 2. Copies of all test reports, including test forms, general record keeping, and interpretation of results;
 - 3. Copy of complete set of drawings showing where all fitting bonds and test stations are located.

1.5 QUALITY CONTROL

- A. A qualified Corrosion Engineer specializing in cathodic protection or a Cathodic Protection (CP) Specialist certified with the National Association of Corrosion Engineers shall perform all testing on the cathodic protection system.
- B. It is to the CONTRACTOR's benefit to perform continuity tests on all bonded pipe and fittings throughout each sequence of construction.

C. Continuity Tests

1. All bonded buried and submerged pipe and fittings shall be tested by the CONTRACTOR for electrical continuity after connections have been made and before burial. The electrical continuity must be re-tested once the pipeline has been completed, but before pressure testing. The approved Corrosion Engineer or CP Specialist shall conduct testing. A Contractor personnel that has been trained and certified by the approved Corrosion Engineer or CP Specialist can perform the joint bond testing prior to backfilling. The Corrosion Engineer or CP Specialist must perform the final electrical continuity test after completion and before pressure testing
2. If electrical continuity is not achieved as required, the CONTRACTOR shall complete the necessary repairs and retest to prove electrical continuity. Records of all test results, including test locations and equipment used for testing shall be submitted to the ENGINEER, prior to burial, for evaluation and acceptance or recommendations.

D. Isolation Joints

1. All isolation joints shall be tested and recorded under the supervision/consultation of the Corrosion Engineer or CP Specialist, prior to burial.
2. All of the isolation joints shall be tested and recorded, by the Corrosion Engineer or CP Specialist during the final testing.

E. Final Tests

The CONTRACTOR shall install all test stations and additional materials to existing test stations as shown on the drawings and specified herein. After installation of all corrosion monitoring facilities is complete, the Corrosion Engineer or CP Specialist shall test to assure that all Specifications and Drawings have been complied with and the corrosion monitoring system has been installed and working properly. After completion of all tests and inspections, a detailed report describing any deficiencies detected will be submitted to the CONTRACTOR. The CONTRACTOR shall make all repairs necessary to correct these deficiencies at his own expense. The system shall then be retested prior to Final Acceptance. The CONTRACTOR shall pay for all retests made necessary by the corrections.

F. Exothermic Weld and Pin Brazing Qualifying

Skilled personnel who have had adequate experience in the methods and materials to be used shall do all thermite welding and pin brazing. The Corrosion Engineer or CP Specialist prior to commencing work on the pipeline shall qualify thermite welder and pin brazing personnel. Equipment similar to those used in the work shall be used in qualification tests. The CONTRACTOR shall furnish all material and bear the expense of

qualifying thermite welders and bond tester. The Corrosion Engineer or CP Specialist shall provide a photograph and name of all personnel that is certified to perform the thermite welding, pin brazing, and bond testing to the ENGINEER for approval.

PART 2 PRODUCTS

2.1 GENERAL

- A. All materials shall conform to the requirements set forth herein or as designated on the drawings, unless otherwise specified. All materials must be new, free from defects and shall be of the best commercial quality for the purpose specified. All necessary items and accessories not shown on the drawings or specified herein, but which are required to fully carry out the specified intent of the work, shall be furnished without additional cost to the ENGINEER.
- B. The CONTRACTOR is responsible to coordinate material compatibility. All components and materials may not be supplied by the same manufacturer; therefore, the CONTRACTOR shall supply the necessary dimensions and materials characteristics to the respective material supplier to ensure the finished product is free of defects and irregularities that could occur from unmatched components.
- C. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the contract documents.

2.2 MATERIAL SUPPLIERS

Suppliers listed below can usually supply the types of materials specified in this section. Alternate suppliers will be considered, subject to approval of the ENGINEER. The cities and phone number listed is the manufacturer's nearest representative office to the project site, that we know of; these offices can inform the CONTRACTOR if they have anyone closer.

- Cathodic Protection Engineering, West Linn, OR; 503/720-3220
- Corpro/ Aegion, Hayward, CA; 510/614-8800
- Farwest Corrosion Control, Mukilteo, WA; 425/290-8832
- Mesa Products, Mukilteo, WA; 425/903-4850
- Matcor, Inc., Houston, TX; 281/558-2600

2.3 BOND WIRES

General: fitting bond wires shall be no. 2 single-conductor, stranded copper wire with 600-volt HMWPE insulation. Supply all fitting bonds complete with a formed copper sleeve on each end of the wire.

2.4 CATHODIC PROTECTION TEST STATION

A. Flush Mounted Test Station (Standard):

1. Test Box: Concrete body cast with a cast iron ring, with a minimum weight of 55 pounds and minimum dimensions of 8-inch inside diameter and 12-inches long. Furnish extensions as required to penetrate concrete surfaces by 4-inches minimum. Furnish with a 12-pound cast iron lid with the letters "TS" or words "Test Station" cast into the lid.
2. Terminal Block: Plastic or glass-reinforced, ¼- inch thick laminate terminal board with minimum dimensions of 4-inches by 5-inches. Furnish terminal block with a minimum of nine (9) terminals. Terminal nuts and studs shall be ¼-inch with double nuts for securing the studs to the terminal board. Terminal nuts, studs, flat and lock washers shall be Series 300 stainless steel.
3. Magnetic Switch:
 - a. The magnetic switch to be installed on terminal boards of new test stations shall be model SM-ADJ as manufactured by Electrochemical Devices, Inc., or approved equal. The magnetic switch shall have the following electrical specifications:
 - 1) Switching Current: 0.5 amps
 - 2) Carry current: 1.0 amp
 - 3) Switching Voltage: 175 volts
 - 4) Breakdown voltage: min. 200 VDC
 - 5) Contact resistance: 150 mohm
 - 6) Operating temp.: -40F to 260F
 - b. Switch Operator: Shall be an activation magnet to open and close the sealed switch, as manufactured by EDI, Model SM-MAG, or equal.

B. Test Station Wires

1. Wire: Single-conductor, No. 8 and No. 12 AWG stranded copper with 600-volt THWN, or THHN insulation (test stations) and single-conductor.
2. Insulation Color:
 - a. New Pipe at insulator – white
 - b. Existing Pipe at insulator – blue
 - c. Coupon – green, with one set having red tape
 - d. Reference electrode – yellow
 - e. Casing – orange
 - f. Crossing- blue having white tape

2.5 PERMANENT REFERENCE ELECTRODES

Copper/Copper Sulfate Electrodes (CSE):

- A. Material: Permanent type copper-copper sulfate reference electrode suitable for direct burial with a minimum design life of 30 years.
- B. Wire: No. 12 AWG stranded copper wire with yellow, 600-volt THWN, OR THHN insulation. The wire shall be sufficient length to reach the test station plus 10-feet and attached to the electrode core by the manufacturer's standard connection. Connection shall be stronger than the wire.
- C. Acceptable Reference Electrodes: GMC model CU-1-UGPC; or equal.

2.6 CATHODIC PROTECTION MONITORING COUPONS

- A. Provide coupons, steel or ductile iron to match the pipe material type. The coupon shall have 2 wires connected with a silver soldered potted connection, and with a minimum length of 25 feet.
- B. Acceptable Monitoring Coupons: MC Miller IR-Free coupons or approved equal.

2.7 EXOTHERMIC WELD MATERIALS

- A. General: Thermite weld materials shall consist of wire sleeves, welders, and weld cartridges according to the weld manufacturer's recommendations for each wire size and pipe or fitting size and material. All welding materials and equipment shall be the product of a single manufacturer. Interchanging materials of different manufacturers will not be acceptable.
- B. Molds: Graphite. Ceramic "One-Shot" molds will not be acceptable.
- C. Cartridges: Cast iron thermite weld cartridges shall be used for all cast and ductile iron pipe and fittings. Maximum cartridge size shall be 25 grams for steel and 32 grams for cast and ductile iron materials, respectively.
- D. Welders and Cartridges: Provide the thermite weld materials for attaching copper wire to the pipe material using the appropriate types recommended by manufacturer.
- E. Acceptable Suppliers: Erico Products Inc. (Cadweld), Cleveland, OH; Continental Industries, Inc. (Thermo-weld), Tulsa, OK; or equal.

2.8 PIN BRAZING

- A. Pin brazing shall be provided for connecting wires to structures in strict accordance with the manufacturer's recommendations. Connections shall be made at locations indicated.
- B. The pin brazing unit shall use an electric-arc silver soldering process specifically designed to minimize the pipeline heat effects associated with the wire connection process.
- C. The brazing gun ferule holder shall be sized accordingly to accommodate the brazing pin and ferule.
- D. The brazing pin shall be a direct-connect type, with no threaded connections.
- E. The ferrule shall be ceramic and sized accordingly to accommodate the brazing pin.
- F. The wire lug shall be the brazed connection type; crimp lugs shall not be allowed.
- G. All pin brazing hardware and consumable material shall be the product of a single manufacturer. Pin brazing shall be "BAC Pin Brazing" by BAC Corrosion Control. The wire lug shall be type M1. The brazing pins shall be type "Direct Brazing pin, standard with fuse wire" for brazing No. 6 AWG wire and smaller. The brazing pins shall be type "Direct Brazing pin, extra solder with fuse wire" for brazing No. 4 AWG wire and larger.

2.9 EXOTHERIC WELD / PIN BRAZING COATING MATERIALS

- A. Thermite weld connections shall be coated with the following materials as per manufacturer's recommendations.
 - 1. Royston Handy Cap IP

2.10 WIRE CONNECTORS

- A. Test Station: One-piece, tin-plated crimp-on lug connector as manufactured by Burndy Co., Thomas and Betts, or equal.
- B. All test station fastening hardware shall be stainless steel.

2.11 INSULATING JOINTS

- A. Insulating Joints: Flanges or couplings.
 - 1. Complete assembly shall have an ANSI rating equal to or higher than that of the joint and pipeline.

2. Materials shall be resistant for the intended exposure, operation temperatures, and products in the pipeline.
- B. Flange Insulating Kits:
1. Gaskets: Gaskets shall be full face and conform to ANSI B16.21, suitable for the operating and test pressures of the pipe system. Gaskets shall be non-asbestos and non-phenolic. Gaskets shall be Garlock Gylon 3505, or approved equal.
 2. Insulating Sleeves: Full-length fiberglass reinforced epoxy (NEMA G-10 grade).
 3. Insulated Washers: Fiberglass reinforced epoxy (NEMA G-10 grade).
 4. Steel Washers: Plated, hot-rolled steel, 1/8-inch thick.
 5. Manufacturers:
 - a. Pacific Seal, Inc., Burbank, CA.
 - b. Central Plastics Co., Shawnee, OK.
- C. Flexible Insulated 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 included in Section 33 11 10 – *Water Utility Distribution & Transmission Piping*, with insulating boot as specified herein.
 - 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.

2.12 ELECTRICAL TAPE

Linerless rubber high-voltage splicing tape suitable for moist and wet environments, such as Scotch 130C and Scotch 88, as manufactured by 3M Products, or equal.

2.13 WIRE INSULATION REPAIR

Wires shall be handled with care. Splices for damage to the wire insulation shall be required by spirally wrapping (50 percent overlay, minimum) with two coats of high-voltage rubber splicing tape and two layers of vinyl electrical tape. Wire splices shall be made with suitable sized copper compression or copper split bolt connectors as specified under PRODUCTS, this section, or mechanically secured and soldered with rosin cored 50/50 solder. The ENGINEER shall approve all splices.

2.14 WIRE CONNECTORS

- A. Suitable sized compression connector, such as Copper Crimpit™ Model YC, manufactured by Burndy. The Hytool crimp tool, with correct sized die shall be used to make the compression connector.
- B. Suitable sized split copper split bolts, as manufactured by Burndy.

2.15 WAX TAPE COATING AND POLYETHYLENE ENCASUREMENT FOR DI PIPE AND FITTINGS

See Specification Section 33 11 10, *Water Utility and Transmission Piping* for requirements. All ductile iron pipe, ductile iron fittings, and valves for all proposed pipelines require wax tape coating and polyethylene encasement in accordance with the drawings and specifications.

2.16 PVC TAPE COATING FOR BURIED BRASS AND GALVANIZED PIPING

- A. PVC Tape - Premium vinyl electrical tape 8.5 mil thick, such as 3M Scotch Super 88, or approved equal.

2.17 FIELD TESTING EQUIPMENT

- A. See Sections 3.10A and 3.10B.

PART 3 EXECUTION

3.1 GENERAL

- A. The installation of the facilities herein specified and described shall conform to the latest applicable rules as set forth herein. Equipment or materials damaged in shipment or during installation shall be replaced at no additional expense to the Owner.

- B. All materials and equipment associated with fitting bonding, test stations, reference electrodes, and monitoring coupons, as shown and specified herein shall be furnished and installed by the CONTRACTOR. The ENGINEER shall review any changes in design or method of installation of an item as specified.
- C. All materials, workmanship and installation shall conform to all requirements of the legally constituted authority having jurisdiction. These authorities include, but are not limited to, the National Electric Code, General Construction Safety Orders of the Industrial Accident Commission; and all other applicable State, County, or City codes and regulations.
- D. Whenever the requirements of the specifications or drawings exceed those of the codes or manufacturer's instructions, the requirements of the specifications or drawings shall prevail. Where a larger size or better grade of material or a higher standard of workmanship is required, the most stringent requirement shall apply. Nothing in the Drawings or Specifications is to be construed to permit work not conforming to these regulations and codes. The CONTRACTOR shall be responsible for obtaining any required permits and inspections.
- E. All materials and equipment to be used in construction shall be stored in such a manner to be protected from detrimental effects from the elements. If actual storage cannot be affected, materials and equipment shall be stacked well above ground level and protected from the elements as appropriate.

3.2 PIPE BONDING

- A. Electrically bond the joints of buried ductile iron pipe, including fittings, manhole piping, and restrained joints, except joints specified to be threaded, welded, or insulated.
- B. Install two joint bond wire assemblies at each joint that requires bonding.
- C. Use thermite weld process for electrical connection of wires to pipe and fittings.
- D. Test each bonded joint for continuity.

3.3 TEST STATION INSTALLATION

- A. The general locations of the test stations are shown on the Drawings. The CONTRACTOR shall determine the location of the test stations based on actual site conditions and as approved by the ENGINEER.
- B. Test stations shall be located off the roadway, location as approved by the ENGINEER, where shown on the Drawings.

- C. Test wires shall be attached to the pipe as specified under WIRE CONNECTIONS, this section.
- D. Locate flush-mounted test station behind curb where applicable.
- E. The pipe, monitoring coupons, and reference electrode wires shall be buried a minimum of 36 inches below finished grade.
- F. Wire connections to test station terminals shall be with crimp-on spade lug terminals, except where solid wire is specified or terminal strips with tubular clamps are used.

3.4 REFERENCE ELECTRODES

- A. Remove plastic or paper wrapper, if any prior to installation. Place reference electrode a maximum of one-half foot from pipeline. Pour 1 gallon of water over electrode, prior to backfilling. Wire shall be buried a minimum of 36 inches below finished grade.

3.5 MONITORING COUPONS

- A. Place the monitoring coupons a maximum of one-half foot from pipeline. Wire shall be buried a minimum of 36 inches below finished grade.

3.6 WIRE CONNECTIONS

- A. The electrical connections of copper wire to steel, ductile, and cast-iron surfaces shall be by the thermite weld or pin brazing method. Observe proper safety precautions, welding procedures, thermite weld or pin brazing material selection, and surface preparation as recommended by the welder or pin brazing manufacturer. Assure that the pipe or fitting wall thickness is of sufficient thickness that the thermite weld process will not damage the integrity of the fitting wall or protective lining.
- B. Before the connection is made, the surface shall be cleaned to bare metal by making a 2-inch by 2-inch window in the coating, and then filing or grinding the surface to produce a bright metal finish. All grinding shall be with a vitrified type-grinding wheel; the use of a resin, rubber, or shellac-impregnated type grinding wheel will not be acceptable. The prepared metal surface shall be dry.
- C. Wire sleeves shall be installed on the ends of the wires before welding to the metal surface. Thermite welding shall be performed in strict accordance with the manufacturer's written instructions. After the connection has cooled, remove slag and physically test wire connection by hitting with a hammer while pulling on the wire at a 45° angle; remove and replace any defective connections.
- D. Coat wire connection with a thermite weld cap.

3.7 WAX TAPE COATING AND POLYETHYLENE ENCASEMENT FOR DI PIPE AND FITTINGS

- A. See Specification Section 02620, *Ductile Iron Pipe, Fittings and Special Items* and Section 02640, *PVC Pressure Pipe, Fittings & Special Items* for requirements. All ductile iron pipe, ductile iron fittings, and valves for all proposed pipelines require wax tape coating and polyethylene encasement in accordance with the drawings and specifications.

3.8 PVC TAPE WRAP FOR BURIED BRASS AND GALVANIZED PIPING

- A. All buried saddle taps and buried brass piping shall be completely coated PVC tape wrap system as described herein. PVC tape to be applied with a suitable primer, as required. The spirally-wrapped PVC tape shall have a nominal minimum thickness of 17 mils, consisting of either one layer of 17-mil tape or two separate layers of 8.5-mil tape.
- B. Before the primer and wrap is applied, the piping shall be thoroughly cleaned so that all surfaces shall be dry and free of dirt, dust, rust, oil scale, oil, grease, or other foreign matter. Any solvents used shall be totally volatile so as to leave no trace of oil. Weld spatters, burrs, or sharp points and edges shall be removed by chiseling, ball peening or filing. After thorough cleaning, the piping shall be coated with a primer applied in accordance with the tape manufacturer's recommendations. Spiral wrappings shall be applied with an overlap of at least 1-inch.

3.9 SURFACE RESTORATION

- A. Surface restoration shall be as approved by ENGINEER and as detailed within these Specifications.

3.10 FIELD TESTING

- A. Test Equipment: Before construction begins, obtain the test equipment necessary for testing:
 - 1. Model RF-IT radio frequency insulator tester, as manufactured by Tinker and Rasor, or equal
 - 2. An Fluke Model 80 Series, 27 II, 170, or equal
 - 3. Activating magnet Model SM-MAG, 5/8 inch diameter by 2 inch long, as manufactured by Electrochemical Devices, Inc.
 - 4. Two Model 6B Copper-Copper Sulfate reference electrodes, as manufactured by Tinker and Rasor, or equal
 - 5. 1 quart of copper sulfate anti-freeze solution

6. ½-pound of copper sulfate crystals.
- B. Store test equipment at the project site and maintain in accurately calibrated, working condition. The test equipment shall be available to the ENGINEER for testing purposes. Upon completion of the project, the test equipment listed above shall be turned over to the OWNER in clean, accurate, and fully functional condition, along with operation manuals, test wires, and cases supplied with the equipment.
- C. Electrical Continuity Testing – Prior to Backfilling

Furnish all necessary equipment and materials and make all electrical connections to the pipe as required to test continuity of bonded joints.

Conduct a continuity test on all buried joints that are required to be bonded. Test the electrical continuity of joint bonds after the bonds are installed but before backfilling of the pipe.

The CONTRACTOR's Cathodic Protection Specialist shall monitor the test of each bonded joint prior to burial. The CONTRACTOR shall provide the name and certificate of the person that will be performing the testing prior to the start of the project.

The CONTRACTOR shall test electrical continuity of completed joint bonds using either a digital low resistance ohmmeter or by the Calculated Resistance Method at the CONTRACTOR's option. The equipment and test procedures for the two methods are described herein.

1. Digital Low Resistance Ohmmeter Method:

- a. Furnish the following equipment and materials:

- 1) One Biddle Model 247001 digital low resistance ohmmeter; or equal
- 2) One set of duplex helical current and potential hand spikes, Biddle Model No. 241001, cable length as required; or equal
- 3) One calibration shunt rated at 0.001 ohms, 100 amperes, Biddle Model No. 249004, or equal

- b. Test Procedure: Measure the resistance of joint bonds with the low resistance ohmmeter in accordance with the manufacturer's written instructions. Use the helical hand spikes to contact the pipe on each side of the joint, without touching the thermite weld or the bond. The contact area shall be cleaned to bright metal by filing or grinding and without any surface rusting or oxidation. Record the measured joint bond resistance on test form described herein. Repair any damaged pipe coating in accordance with WIRE CONNECTIONS, this section.

2. Calculated Resistance Method:

a. Furnish the following equipment and materials:

- 1) One dc ammeter (meter or clamp-on) with full scale reading of 100 amperes and a minimum resolution of 1 ampere or a 100-ampere shunt with a voltmeter as specified herein.
- 2) One high-resistance electronic voltmeter with a dc low range of 200 millivolt full scale to a dc high range of 20 volts full scale and capable of a minimum resolution of 1 millivolt (two voltmeters are required if a shunt is used for item a. above).
- 3) One knife switch, safety switch, or time controlled relay suitable for test current.
- 4) Two electrical probes for the voltmeter.
- 5) Insulated wire suitable for carrying the test current, length as required.
- 6) One dc power supply with a steady capacity of 50 amperes minimum; storage batteries are not an acceptable power supply.

b. Test Procedure:

- 1) The test setup shall be as shown at the end of this section. Current wire connections shall be either tightly clamped or thermite welded to the pipe at the CONTRACTOR's option. Wire size shall be determined by the CONTRACTOR and shall be sized for the test current, and shall not exceed 1,000 feet in length.
 - a) Apply a minimum direct current of 50 amperes.
 - b) Measure the voltage drop across each joint with a voltmeter by contacting the pipe on each side of the joint. Voltmeter connections to the bond wire or thermite welds will not be acceptable.
 - c) Measure the current applied to the test span and the voltage drop across the joint simultaneously.
 - d) Record the measured voltage drop and current for each joint on the test form described herein and calculate the bond resistance in accordance with the following formula:

$$R = E/I$$

Where:

R = Resistance of the joint bond, in ohms

E = Measured voltage drop across the joint, in volts

I = Test current applied to the pipe test span, in amperes

D. Joint Bond Acceptance:

1. Joint bond resistance shall be less than or equal to the maximum allowable bond resistance values shown in the below table.

Joint Type	Max. Allowable Resistance 2 Bonds/Joint
Push-On or Mechanical	0.000169 ohm
Flexible Coupling	0.000219 ohm

(The above resistance considers 18- and 24-inch long bond wires, respectively)

2. The CONTRACTOR shall replace any joint bond, which exceeds the allowable resistance or add additional joint bonds, at his option. Replacement joint bonds and/or additional bonds shall be retested for compliance with the specified bond resistance.
3. The CONTRACTOR shall repair defective joint bonds discovered during the energizing and testing procedure.

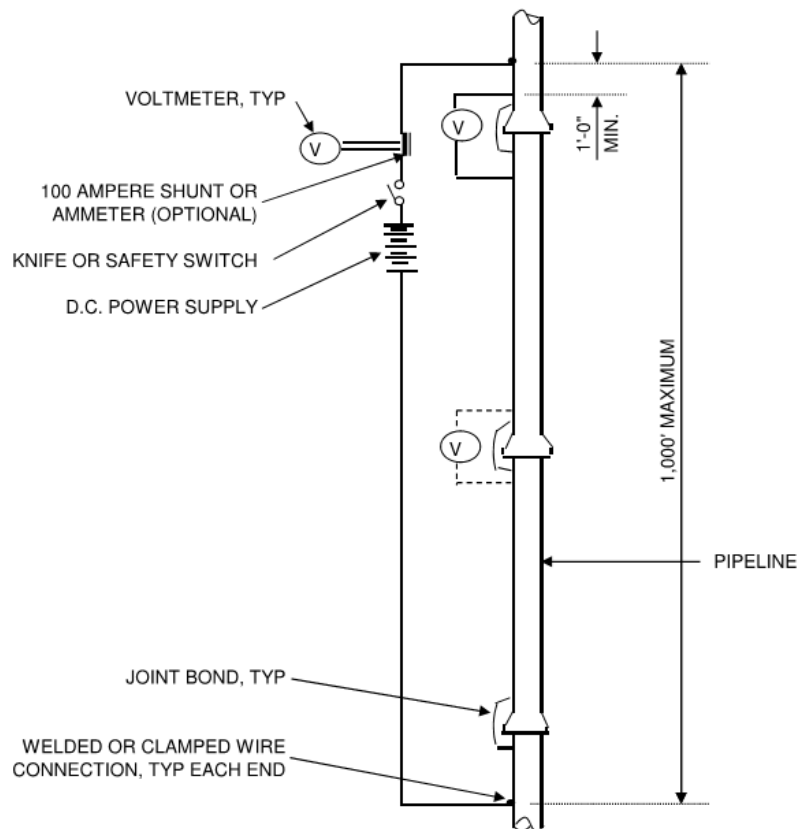
E. Record Test of Each Bonded Pipeline:

1. Description and location of the pipeline tested
2. Starting location and direction of test
3. Date of test
4. Joint type
5. Test current and voltage drop across each joint and calculated bond resistance (Calculated Resistance Method only)
6. Measured joint bond resistance (Digital Low Resistance Ohmmeter method only)

F. Insulated Joint Testing: Test each joint after assembly with the insulator tester in accordance with the manufacturer's written instructions. Cathodic Protection Specialist shall monitor the test. Replace damaged or defective insulation parts. Provide the ENGINEER with 3 days advance notice before beginning tests.

G. Testing:

1. Energizing and Testing: After the installation of the corrosion monitoring system is complete, the CONTRACTOR's Corrosion Engineer or CP Specialist will make sufficient tests throughout the network of protected casing, piping, fittings, etc. to ensure proper installation of the corrosion monitoring system. Upon completion of such tests, the Corrosion Engineer or CP Specialist who conducted the tests shall tabulate the data recorded. The CONTRACTOR at his sole expense shall correct any construction defects located during energizing and testing.
2. After construction is complete, the Corrosion Engineer or CP Specialist shall test the pipeline to ensure proper installation of the fitting bonds, test stations, and reference cells. Any construction defects identified during testing shall be located and corrected by the CONTRACTOR. Provide the ENGINEER with 3 days advance notice before beginning tests. All test data shall be recorded and submitted to the ENGINEER.
3. (See Joint Bond Continuity Test Schematic following this section)



JOINT BOND CONTINUITY TEST SCHEMATIC

END OF SECTION

SECTION 31 05 13 - SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes 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 18 – Rock Removal.

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 6 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 Fill Material:
 - 1. Imported earth approved for use by Engineer.
 - 2. Meeting the requirements of Subsoil Type S1.

2.2 TOPSOIL MATERIALS

- A. Topsoil Type TS1, Select Native Topsoil Material:
 - 1. Top 6 - 12 inches of existing soil containing organic matter.
 - 2. Engineer decision shall be final as to determination of what material is topsoil quality.
 - 3. Graded.
 - 4. Free of roots, rocks larger than 1/2 inch subsoil, debris, large weeds and foreign matter.
 - a. Screening: Single screened.
- B. Topsoil Type TS2, Imported Topsoil Material:
 - 1. Imported borrow.
 - 2. Friable loam.
 - 3. Reasonably free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
 - a. Screening: Single screened.
 - 4. Acidity range (pH) of 5.5 to 7.5.
 - 5. Containing minimum of 4 percent and maximum of 25 percent inorganic matter.

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 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 topsoil.
- 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 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 22 13 - Rough Grading.
- C. Section 31 23 17 - Trenching.
- D. Section 31 23 19 - Dewatering.
- E. Section 32 11 23 - Aggregate Base Courses.
- F. Section 33 11 10 - Water Utility Distribution and Transmission 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, Dense-Graded Aggregate: Crushed rock with 3/4 inch-0, 1 inch-0, 1-1/2 inch-0, 2 inch-0 and 2-1/2 inch-0 gradation as shown in the Drawings and meeting the requirements provided below.
1. Grading - Dense-graded base aggregate shall be crushed rock, including sand. Uniformly grade the aggregates from coarse to fine.
 2. Sieve analysis shall be determined according to AASHTO T27.
 3. The aggregates shall conform to one of the grading requirements Table 310516-A below.

Table 310516-A
Grading Requirements for Dense-Graded Aggregate
Separated Sizes
Percent Passing (by weight)

Sieve Size	2-1/2" - 0	2" - 0	1-1/2" - 0	1" - 0	3/4" - 0
3"	100				
2-1/2"	95 - 100	100			
2"	-	95 - 100	100		
1-1/2"	-	-	95 - 100	100	
1-1/4"	55 - 75	-	-	-	
1"	-	55 - 75	-	90 - 100	100
3/4"	-	-	55 - 75	-	90 - 100
1/2"	-	-	-	55 - 75	-
3/8"	-	-	-	-	55 - 75
1/4"	30 - 45	30 - 45	35 - 50	40 - 55	40 - 60
No. 4*	-	-	-	-	-
No. 10	1	1	1	1	1

¹ Of the fraction passing the 1/4 inch sieve, 40% to 60% shall pass the No. 10 sieve.

* Report percent passing sieve when no grading requirements are listed.

4. Fracture of Rounded Rock:
 - a. Determined according to AASHTO TP61.
 - b. Provide at least one fractured face based on the following percentage of particles retained on the 1/4-inch sieve for the designated size:

Minimum % of Fractured Particles
by Weight of Material

<u>Designated Size</u>	<u>Retained on 1/4-Inch Sieve</u>
1 1/2" – 0 and larger	50
Smaller than 1 1/2" – 0	70

5. Durability:

a. Crushed rock aggregate shall meet the following durability requirements:

<u>Test</u>	<u>Test Method</u>	<u>Requirements</u>
Abrasion	AASHTO T 96	35.0% maximum
Degradation (Coarse Aggregate)	ODOT TM 208	30.0% maximum
Passing No. 20 Sieve, Sediment Height	ODOT TM 208	3.0" maximum

6. Sand Equivalent -- Crushed rock aggregate will be tested according to AASHTO T 176, and shall have a sand equivalent of not less than 50.

B. Coarse Aggregate Type A2, Granular Drain Backfill Material: Crushed or uncrushed rock or gravel as shown in the Drawings.

1. Material shall be clean and free-draining.
2. Sieve analysis shall be according to AASHTO T27.
3. Grading: Meeting the gradation requirements provided in Table 310516-B below.

Table 310516-B
Grading Requirements for Granular Drain Backfill Material
Separated Sizes
Percent Passing (by weight)

Sieve Size	Separated Sizes 1 1/2" – 3/4"	Separated Sizes 3/4" – 1/2"
2"	100	
1-1/2"	90 - 100	
1"	20 - 55	100
3/4"	0 - 15	85 - 100
1/2"	-	0 - 15
3/8"	0 - 5	-

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-C
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.	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 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 2-inch caliper to a depth of 12 inches below subgrade.
- 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-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 and easements 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 1-800-332-2344 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 or uncontrolled to erosion during installation of temporary erosion and sediment controls and in compliance with the Drawings and DEQ's Best Management Practices Manual.
 - 2. Tree and vegetation protection is installed.
 - a. Protect existing site improvements, trees and shrubs to remain to preclude damage during construction.
 - b. Follow the provisions set forth in Section 01 56 39, Tree and Plant Protection for all temporary tree and plant protection measures.
 - 3. Temporary fencing and dust prevention measures are 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 ROW or erosion control, whichever is nearest to the pipe alignment:
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-inch diameter to the following depths:

1. Future Structures and Building Areas	24 Inches
2. Roads and Parking Areas	18 Inches
3. All other Areas	12 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.

- E. Refer to Section 01 56 39, Temporary Tree and Plant Protection for tree protection requirements.

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 18 - Rock Removal.

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 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.
- C. Structural Fill: Type A1, Dense-Graded Aggregate as specified in Section 31 05 16, Aggregates for Earthwork. Size of aggregate as shown in the Drawings.
- D. Granular Fill: Type A2, Granular Drain Backfill Material as specified in Section 31 05 16, Aggregates for Earthwork. Size of aggregate as shown in the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify survey benchmark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

- A. Call Local Utility Line Information service at 1-800-332-2344 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 designated areas 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 1: 2 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 02 41 00 - Demolition.
- 3. Section 26 42 01 – Corrosion Monitoring System for Ductile Iron Pipe
- 4. Section 31 05 13 - Soils for Earthwork.
- 5. Section 31 05 16 - Aggregates for Earthwork.
- 6. Section 31 10 00 - Site Clearing.
- 7. Section 31 22 13 - Rough Grading.
- 8. Section 31 23 17 - Trenching.
- 9. Section 31 23 18 - Rock Removal.
- 10. Section 31 23 19 - Dewatering.
- 11. Section 31 50 00 - Excavation Support and Protection
- 12. Section 33 11 10 - Water Utility Distribution and Transmission Piping.
- 13. Supplemental Information: Geotechnical Memorandum; bore hole location 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, unless provided as Rock for under Section 31 23 18, Rock Removal below.
- 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. Rock Removal: As defined in Section 31 23 18, Rock Removal.
- H. Spoils: Excavated materials from Site unsuitable for use as fill or not required for backfill and grading.
- I. 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 support plan and utility protection plan as specified in Section 31 50 00, Excavation Support and Protection.

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 overexcavation.
- 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 1-800-332-2344 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 Coarse Aggregate Type A1, 2-1/2 inch – 0 gradation, as specified in Table 310516-A of Section 31 05 16, Aggregates for Earthwork. 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. Remove larger boulders and rock material as specified in Section 31 23 18, Rock Removal.
3. 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 18 - Rock Removal.
 - 9. Section 31 23 24 - Flowable Fill.
 - 10. Section 31 50 00 – Excavation Support and Protection
 - 11. Section 33 11 10 - Water Utility Distribution & Transmission Piping.
 - 12. Section 33 41 10 - Storm Utility Drainage Piping.
 - 13. Supplementary Information: Geotechnical Memorandum; bore hole location and findings of subsurface materials.
 - 14. Supplementary Information: Utility Potholing Data; existing utility crossing depths, pipe sizes, etc.

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. Geosynthetics: Geotextiles, geogrids, geomembranes, and drainage composite materials.
- D. Imported Material: Materials obtained from sources offsite, suitable for specified use.
- E. Lift: Loose (uncompacted) layer of material.
- F. Obstructions: Items which may be encountered during utility and vault trenching which do not require replacement.
- G. 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.
- H. Pipe Bedding: Trench backfill zone for full trench width which extends from the bottom outside surface of the pipe to a minimum of 6 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.

- I. Pipe Zone: Trench backfill zone for full trench width which extends from the bottom outside surface of the pipe to a minimum of 12 inches above the top outside surface of pipe, conduit, cable or duct bank.
- J. Pipe Bedding, 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 A1 as specified in Section 31 05 16, Aggregates for Earthwork; typical designated size shall be 1"-0 or $\frac{3}{4}$ "-0.
 - 3. Class C: Backfill with Fine 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 Section 31 23 24, Flowable Fill.
- 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: Trench backfill zone for full trench width extending from the top of the pipe zone to pavement base rock, ground surface or other surface material.
- Q. Trench Stabilization: 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.
- 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 support plan and utility protection plan as specified in Section 31 50 00, Excavation Support and Protection
- 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. Marker balls;
 - 7. Locator stations;
 - 8. Ground wires;
 - 9. Plastic or copper markers for service laterals.
- 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 Section 31 23 24, Flowable Fill.
- 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 FILL 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, Dense-Graded Aggregate 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 Section 31 23 24, Flowable Fill, 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. Trench Stabilization Material: Coarse Aggregate Type A1, Dense-Graded Aggregate, 2-1/2" - 0 gradation as specified in Section 31 05 16, Aggregates for Earthwork.

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. Marker Balls:
1. Exterior Material: High-density polyethylene.
 2. Size: Maximum 4.5 inches in diameter.
 3. Range: Locatable with standard electronic marker locating devices at depths up to 5 feet.
 4. Field Type: Spherical RF field regardless of orientation.
 5. Contain no floating or movable parts, and no batteries or active components.
 6. Color: Provide colored marker balls per Article 2.03 B above.

7. Manufacturer and Product: Omni Marker Model 162 (green), Omni Marker Model 161 (blue), or approved equal.
- B. 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.
- C. 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; DryConn™ 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.
- D. Ground Wire: No. 12 AWG bare solid copper wire.
- E. 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.

2.4 VISUAL IDENTIFICATION MATERIALS

A. Tracer Wire Locate Boxes:

- 1. Material: Polyolefin.
- 2. Cover:
 - a. Color: Provide in colors per Article 2.03 B above.
 - b. Provide box cover identification marking for facility type such as “Sewer Locate Wire”, as approved by Owner.
 - c. Locking type with a nominal 6-inch opening.
- 3. Manufacturer and Product: Carson Industries LLC; L Series Model 708, or approved equal.

B. Service Lateral Plastic or Copper Markers:

- 1. Service Lateral Plastic or Copper Markers: Use markers of the type that requires installation to be recessed below grade.
 - a. Material: Plastic or copper. In new concrete, use “new construction” markers; in existing concrete use “retrofit” markers and use adhesive recommended by the manufacturer.
 - b. Plastic Pavement Markers:
 - 1) UV stabilized and fade resistant.

- 2) Material: Meet or exceed a tensile strength of 3,500 psi, and meet test requirements as outlined in ASTM G53, Standard Practice for Light and Water Exposure of Nonmetallic Material.
- 3) Color: Provide in color per Article 2.03 B above with the words, "WARNING, BURIED [UTILITY TYPE], Call Before You Dig," molded to the top of marker.
 - a) Provide wording for specific facility as approved by Owner.
- 4) Manufacturer and Product: Rhino Marking and Protective Systems; A-TAG pavement markers, or approved equal.

c. Copper Pavement Markers:

- 1) Material: Copper material chosen by manufacturer.
- 2) Diameter: 1-5/32 inch.
- 3) Wording: Provide facility identification wording stamped on the top such as "Sewer Lateral" as approved by Owner.
- 4) Manufacturer and Product: Berntsen Concrete Marker; BP2-U, or approved equal.

C. Service Lateral 2-inch by 4-inch Markers:

1. S4S Douglas fir, pressure-treated 2-inch by 4-inch lumber, utility grade or better.
2. Grade stamped by an American Lumber Standards certified inspection agency.

PART 3 EXECUTION

3.1 PREPARATION

- A. Call Local Utility Line Information service at 1-800-332-2344 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. Transmission water mains shall be installed with a minimum cover of 60 inches, except where shown otherwise on the Drawings.
- 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 Contractor 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. Remove larger boulders and rock material as specified in Section 31 23 18, Rock Removal.
- 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 18 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. 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. A suitably sized pipe plug shall be provided to prevent the entrance of objectionable material into the pipe, and plug shall be installed in the open end of the pipe trench whenever the work allows.
 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. Over excavation 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 A1, 2-1/2 inch – 0 gradation, as specified in Table 310516-A of 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.
- 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 designated areas 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 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.

3.10 BEDDING

- A. All utility vaults, potable water pipe 4-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 4-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.

3.11 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 B or Class E and pipe zone backfill shall be Class B or Class E. Class B 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 B 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.

3.12 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.

3.13 ELECTRONIC LOCATING FACILITY INSTALLATION

- A. Marker Balls:
 - 1. Install according to manufacturer’s recommendations and as shown or directed and according to the following requirements:
 - a. Install marker balls directly above the pipe alignment at a depth no less than 3 feet and no more than 4.5 feet below final surface grade.

- b. Install marker balls during trench backfill operations by placing the marker ball in compacted backfill.
- c. Cover marker ball with a minimum of 6 inches of backfill and compact backfill before continuing trench backfill operations.
- d. Install markers balls with trenchless pipe installations by core-drilling hole of a minimal diameter needed to allow clearance for placement of marker ball. Backfill with approved trench backfill, pavement base and pavement, as applicable.

2. Water Marker Ball Locations:

- a. Install marker balls directly above connection points, air valve and service taps, termination points and all fitting locations, and at a minimum spacing of 100 linear feet on water lines with a straight horizontal alignment.
- b. Install marker balls at a minimum spacing of 50 lineal feet directly above water mains installed on a deflected radius of curvature.

B. 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 water pipe trenches.
- b. Extend tracer wire to surface at valve boxes. Extend the tracer wire in one continuous piece up vertically from the pipe trench and into the bottom of the valve can. Leave 18 inches of coiled tracer wire inside valve can.

3.14 FIELD QUALITY CONTROL

- A. All testing and reporting shall be conducted and completed by an independent laboratory provided by the Owner. Testing will be paid for 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, one test per 200 lineal 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.

3.15 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 18

ROCK REMOVAL

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes removal of subsurface rock during excavation by mechanical method. The use of explosives for rock removal is not permitting for this project.
- B. Section Includes:
 - 1. Removing identified and discovered rock during excavation.
 - 2. Expansive tools to assist rock removal.
- C. Related Sections:
 - 1. Section 31 22 13 - Rough Grading.
 - 2. Section 31 23 16 - Excavation: Building excavation.
 - 3. Section 31 23 17 - Trenching: Trenching and backfilling for utilities.
 - 4. Supplementary Information: Geotechnical Memorandum; bore hole location and findings of subsurface materials.

1.2 DEFINITIONS

- A. Common Excavation: All excavation required for Work, regardless of the type, character, composition or condition of the material encountered. All excavation shall be classified as Common Excavation, unless provided for under Rock Removal below.
- B. Common Material: All soils, aggregate, debris, junk, broken concrete, and miscellaneous material encountered in Common Excavation, excluding rock as defined below.
- C. Rock: Solid mineral material, including boulders, solid bedrock, or ledge rock, with volume in excess of 1/2 cubic yard or solid material which, by actual demonstration, cannot be reasonably excavated with suitable machinery as defined herein. The Engineer may waive the requirements for actual demonstration if the material encountered is well-defined rock.
- D. Rock Removal: Removal of rock as defined herein by systematic and continuous drilling, hammering, breaking, splitting or other methods approved by the Engineer.

- E. Suitable Machinery: A track-mounted hydraulic excavator of the 52,800 to 72,500-pound class equipped with a single shank ripper.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate proposed method of rock removal.
- C. Equipment: Manufacturer information regarding pound class of machinery proposed for rock removal.
- D. Survey Report: Submit survey report mapping extent and locations of rock encountered, to be used in calculating total volume of rock removal.

1.4 PROJECT CONDITIONS

- A. Conduct survey of rock uncovered in excavation for structures or trenching for utilities prior to removal of material.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions and note subsurface irregularities affecting Work of this section.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Engineer Approval for Rock Removal:
 - 1. Prior to commencement of rock removal, expose all material anticipated to be rock by removing the common material above it and then notify the Engineer.
 - 2. The Engineer, in association with the Contactor or the Contractor's representative, will measure the amount of material to be removed in an effort to reach a mutually agreeable volume for anticipated rock removal.
 - 3. Prior to commencing the proposed rock removal, the Contractor must receive written approval by the Engineer stating the approximate volume of excepted rock removal to receive payment.

4. During rock removal activities, should it become apparent the previously agreed upon volume of rock removal will be exceeded, notify the Engineer immediately. Should the Contractor proceed with rock removal in excess of the previously agreed upon volume, the Contractor will do so at their own risk and expense.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

- A. Excavate and remove rock by mechanical method.
 1. Use single shank ripper to fracture rock.
 2. Drill holes and use expansive tools and wedges to fracture rock.
- B. Cut away rock at bottom of excavation to form level bearing.
- C. Remove shaled layers to provide sound and unshattered base for footings and foundations.
- D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
- E. For vaults and other structures, excavate to the depth necessary to install the structure and to a maximum of 18 inches beyond the outside walls of the vault or structure.
- F. Remove excavated materials from site.
- G. Correct unauthorized rock removal associated with structural excavations in accordance with backfilling and compacting requirements of Section 31 23 16, Excavation and as directed by Engineer.
- H. Correct unauthorized rock removal associated with utility work in accordance with backfilling and compacting requirements of Section 31 23 17, Trenching and as directed by Engineer.
- I. If material which would be classified as rock as defined herein is mechanically removed with equipment of a larger size than specified as Suitable Machinery herein, it shall be understood that any added costs for the removal of rock by this method shall be included in the unit price for common excavation and not paid for under this pay item. If material which would be classified as rock as defined herein is mechanically removed without [blasting,] hammering, breaking or splitting, it will be considered common excavation and not paid for under this pay item. If equipment larger than the suitable machinery as defined herein is brought on the project site for the sole purpose of rock removal without hammering, breaking or splitting, then such excavation will be considered rock removal.

3.4 FIELD QUALITY CONTROL

- A. Request visual inspection of foundation bearing surfaces by Engineer before installing subsequent work.

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.
- E. Section 31 50 00 - Excavation Support and Protection.
- F. Supplementary Information: Geotechnical Memorandum; bore hole location, findings of subsurface materials, and dewatering discussions

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 gravity 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 24 - FLOWABLE FILL

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes flowable lean concrete mix used for structure backfill, utility bedding and backfill and other subgrade Site Work. Applications also include filling abandoned structures and utilities that remain in place.
- B. Section Includes:
 - 1. Structure backfill
 - 2. Utility bedding
 - 3. Utility backfill
 - 4. Filling abandoned utilities

1.2 RELATED SECTIONS

- A. Section 33 11 50 - Existing Pipe Abandonment
- B. Section 31 23 16 - Excavation
- C. Section 31 23 17 - Trenching
- D. Section 33 11 10 - Water Utility Distribution and Transmission Piping
- E. Section 33 41 10 - Storm Utility Drainage Piping

1.3 DEFINITIONS

- A. Flowable Fill: Also referred to as Controlled Low Strength Material (CLSM) elsewhere in the Specifications. Lean cement concrete fill.
- B. Utility: Any buried pipe, duct, conduit, manhole, tank, or cable.

1.4 REFERENCE STANDARDS

- A. ASTM International (ASTM):
 - 1. ASTM C33 - Standard Specification for Concrete Aggregates
 - 2. ASTM C94 - Standard Specification for Ready-Mixed Concrete
 - 3. ASTM C150 - Standard Specification for Portland Cement
 - 4. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete
 - 5. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

6. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete
7. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
8. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
9. ASTM C1040 - Standard Test Methods for Density of Unhardened and Hardened Concrete in Place by Nuclear Methods
10. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- C. Field Quality-Control Submittals:
 1. Mix Design:
 - a. Furnish flowable fill mix design for each specified strength.
 - b. Furnish separate mix designs when admixtures are required for the following:
 - 1) Flowable fill Work during hot and cold weather.
 - 2) Air entrained flowable fill Work.
 - c. Identify design mix ingredients, proportions, properties, admixtures, and tests.
 2. Furnish test results to certify flowable fill mix design properties meet or exceed specified requirements.
- D. Delivery Tickets:
 1. Furnish duplicate delivery tickets indicating actual materials delivered to Project Site.

1.6 QUALITY ASSURANCE

- A. In-place testing of Flowable Fill: In accordance with ASTM C403.
- B. Compressive testing of Flowable Fill: In accordance with ASTM D4832.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Minimum Conditions: The following minimum conditions shall be met at time of flowable fill placement.
 - 1. Do not install flowable fill during inclement weather.
 - 2. Ambient temperature must be at least 34 degrees Fahrenheit (F) (4 degrees Celsius (C)) and rising.
 - 3. Flowable fill shall be at 40 degrees F (4 degrees C).
 - 4. Subgrade on which flowable fill is to be placed shall be free of disturbed or soft material, debris and water.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

PART 2 PRODUCTS

2.1 FLOWABLE FILL

- A. Flowable Fill:
 - 1. Composed of cement, pozzolans, fine aggregate, water, and admixtures.
 - 2. Low cement content.
 - 3. Non-segregating, self-consolidating, free-flowing, and excavatable material which will result in a hardened, dense, non-settling fill.
 - 4. Compressive strength at 28 days of 100 to 200 pounds per square inch (psi), if not otherwise shown in Drawings or specified.

2.2 MATERIALS

- A. Portland Cement: ASTM C150.
- B. Fine Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.

2.3 ADMIXTURES

- A. Air Entrainment: ASTM C260.

- B. Chemical Admixture: ASTM C494.
 - 1. Type A - Water Reducing
 - 2. Type B - Retarding
 - 3. Type C - Accelerating
 - 4. Type D - Water Reducing and Retarding
 - 5. Type E - Water Reducing and Accelerating
 - 6. Type F - Water Reducing, High Range
 - 7. Type G - Water Reducing, High Range, and Retarding
- C. Fly Ash: ASTM C618 Class C or F, obtained from residue of electric generating plant using ground or powdered coal.
- D. Plasticizing: ASTM C1017.

2.4 MIXES

- A. Mix and deliver flowable fill according to ASTM C94, Option C.
- B. Flowable Fill Design Mix:

ITEM	PROPERTIES
Cement Content	75 to 100 lb/cu yd
Fly Ash Content	[None]
Water Content	As specified
Air Entrainment	5 to 35 percent
28-Day Compressive Strength	Maximum 200 psi.
Unit Mass (Wet)	80 [100] to 110 [125] pcf
Temperature, Minimum at Point of Delivery	50 degrees F (10 degrees C)

- C. Provide water content in design mix to produce self-leveling, flowable fill material at time of placement.
- D. Design mix air entrainment and unit mass are for laboratory design mix and source quality control only.
- E. Supplier may adjust mix design included above and/or include admixtures accordingly to optimize flowable fill (CLSM) for filling abandoned pipe utilities via pumping. Submit mix design to Engineer for approval. See Section 33 11 50, Existing Pipe Abandonment.

2.5 SOURCE QUALITY CONTROL

- A. Test and analyze properties of flowable fill design mix and certify results for the following:
 - 1. Design mix proportions by weight of each material.
 - 2. Aggregate: ASTM C33 for material properties and gradation.

3. Properties of plastic flowable fill design mix including:
 - a. Temperature
 - b. Slump
 - c. Air entrainment
 - d. Wet unit mass
 - e. Yield
 - f. Cement factor
 4. Properties of hardened flowable fill design mix including:
 - a. Compressive strength at 1-day, 7 days, and 28 days. Report compressive strength of each specimen and average specimen compressive strength.
 - b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.
- B. Prepare delivery tickets containing the following information:
1. Project designation
 2. Date
 3. Time
 4. Class and quantity of flowable fill
 5. Actual batch proportions
 6. Free moisture content of aggregate
 7. Quantity of water withheld

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify excavation specified in Section 31 23 16, Excavation and trenching specified in Section 31 23 17, Trenching is complete.
- B. Verify utility installation as specified in elsewhere in the specifications is complete and tested before placing flowable fill.
- C. Verify excavation is dry and dewatering system is operating, as may be required, prior to placement of flowable fill.

3.2 PREPARATION

- A. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.

- B. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.
- C. Protect utilities and foundation drains to prevent intrusion of flowable fill.

3.3 INSTALLATION - FILL, BEDDING, AND BACKFILL

- A. Place flowable fill by chute, pumping, or other methods as approved by Engineer.
- B. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.
- C. Place flowable fill evenly on both sides of utilities to maintain alignment.
- D. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.

3.4 INSTALLATION - FILLING ABANDONED UTILITIES

- A. As specified in Section 33 11 50, Existing Pipe Abandonment.

3.5 FIELD QUALITY CONTROL

- A. Perform inspection and testing according to ASTM C94.
 - 1. Take samples for tests for every 100 cubic yards of flowable fill, or fraction thereof, installed each day.
 - 2. Sample, prepare, and test four compressive strength test cylinders according to ASTM D4832. Test one specimen at 3 days, one at 7 days, and two at 28 days.
 - 3. Measure temperature at point of delivery when samples are prepared.
- B. Further construction proceeding upon placed flowable fill will be permitted only after initial set is attained, as measured by ASTM C 403.
 - 1. Perform in place penetration (density) tests using handheld penetrometer to measure penetration resistance of hardened flowable fill.
 - 2. Perform tests at locations as directed by Engineer.
- C. Defective Flowable Fill: The Engineer reserves the right to reject all flowable fill failing to meet the following test requirements or flowable fill delivered without the following documentation.
 - 1. Test Requirements:

- a. Minimum temperature at point of delivery.
- b. Compressive strength requirements for each type of fill.

2. Documentation: Duplicate delivery tickets.

- D. No traffic or construction equipment shall be allowed on flowable fill for a least 24 hours after placement.

3.6 CLEANING

- A. Remove spilled and excess flowable fill from Project Site.
- B. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes shoring and support systems of all types necessary to protect existing utility facilities and new utility facilities.
- B. The Contractor is responsible for the selection and design of excavation support systems and the design of utility support systems in conformance with Federal, State, and City requirements and the minimum design criteria specified herein.
- C. Temporary shoring is to be installed for protection of the existing trees to remain, structures to remain, buried utilities to remain, adjacent roadways and walkways, and surrounding properties.
- D. Care must be taken during the planning and construction of earth support systems to minimize settlements and displacements of the shoring system itself and to surrounding properties.

1.2 RELATED SECTIONS

- A. Section 31 23 16, Excavation
- B. Section 31 23 17, Trenching
- C. Section 31 23 19, Dewatering
- D. Section 31 23 23, Fill
- E. Section 33 11 10, Water Utility Distribution and Transmission Piping.
- F. Section 33 41 10, Storm Utility Drainage Piping.
- G. Supplemental Information: Geotechnical Memorandum; bore hole location, findings of subsurface materials, and design parameters for shoring design

1.3 DESIGN CRITERIA

- A. Design excavation support systems and all components to support the earth pressures, unrelieved hydrostatic pressures, utility loads, equipment, traffic, railroad, and construction loads including impact, and other surcharge loads in such manner as will allow the safe and expeditious construction of the permanent structures to minimize ground movement or settlement, and to prevent damage to adjacent structures, roadways, railroads, and utilities.
- B. Design support members to resist the maximum loads expected to occur during the excavation and support removal stages.

- C. Design system so that water seepage is minimized. Provide dewatering and positive means for preventing sloughing and containing material behind lagging.
- D. Design system to provide intimate contact with excavation sidewall soils at all times to prevent sloughing and to contain running sand and silt behind the lagging. Excavation shall be monitored continuously, and repairs shall be immediately undertaken upon first sign of sloughing, and settlement in the adjacent ground surface.
- E. Vertical support capacity shall be provided for wall systems and internal bracing elements for loads due to vertical force components and live loads on any portion of the system.
- F. Design calculations and shop drawings of all excavation support systems.
 - 1. Calculations and shop drawings shall be made and stamped by a registered Professional Civil or Structural Engineer experienced in the design of excavation support systems in the State of Oregon.
 - 2. Comply with the applicable requirements of OSHA and the Oregon equivalent Structural Specialty Code with respect to excavation and construction.

1.4 SUBMITTALS

- A. Section 01 33 00, Submittals - Submittal Procedures: Requirements for submittals.
- B. Excavation Support Systems
 - 1. Plans and details for trench and excavation support systems.
 - a. Calculations and shop drawings shall be made and stamped by an Oregon-registered Professional Engineer experienced in the design of excavation support systems and shall comply with the applicable requirements of OSHA and the Oregon equivalent Structural Specialty Code with respect to excavation and construction.
 - 1) Arrangement, size, and details for individual excavation support systems.
 - 2) Construction methods and sequencing to be used for the installation and removal of individual excavation support systems.
 - b. Provide plans, details, and calculations for Engineer review prior to the beginning of construction activities requiring such systems.
 - c. Review by the Engineer of the submitted design shall not be construed as a detailed analysis of the adequacy of the support system, nor shall any

provisions of the above requirements be construed as relieving overall responsibility and liability for the work.

2. Provide plans, details, and calculations for trench and excavation support systems to the City of Roseburg as required to obtain all necessary construction permits.
3. No excavations shall be started until the submittal review is complete and proper permits are obtained.

C. Excavation Plan

1. Designed to prevent damage to existing and surrounding properties.

D. Settlement Monitoring Plan, to include the following:

1. Detailed location of settlement monitoring points shown on the Drawings.
2. Reference benchmarks of City and/or County to be employed.
3. Survey procedures (including name of survey crew leader and equipment to be used).
4. Approach to recording surveyed readings and means of reporting of results to the Owner.

E. Contingency Plan

1. Provide alternative procedures to be implemented if the excavation support systems are found to perform unfavorably or if obstructions are encountered in the installation of excavation support systems.
2. Contingency plan is to demonstrate a preparedness to mitigate the effects of movement or settlement.
3. The following minimum requirements for a contingency plan are:
 - a. Measures to be taken in order to protect existing facilities and neighboring properties from additional settlement or movement.
 - b. Identification of all material, manpower, equipment, and other items to be available and onsite at all times while excavations and dewatering activities are ongoing and reasonably after the work has been completed.

F. Site Conditions Survey

1. Videotape surveys, photographs, and other data significant in noting the pre-construction conditions of the existing project site, as well as the pre-construction conditions of the neighboring properties and their existing structures.
2. Provide to the OWNER for record purposes prior to, but not more than 3 weeks before, commencement of any construction activities.
3. A complete set of all photographs and survey data of the post-construction conditions shall be completed and submitted prior to final inspection by the Owner and Engineer.

1.5 QUALITY ASSURANCE

- A. Contractor is solely responsible for quality assurance of temporary shoring.
- B. At each excavation support system location, provide the following:
 1. Continual verification system is planned, executed, and maintained in accordance with applicable codes, regulations, and good construction practice.
 2. Systematic observation of suitability of shoring materials.
 3. Installation, excavation, settlement, and lateral deflection monitoring.
 4. Groundwater control.
 5. Adjacent construction activities.
 6. Other factors, as necessary.
- C. Continually verify installation of the shoring is in conformance with the plans prepared by the Contractor's design engineers.

1.6 CONTRACTOR QUALIFICATIONS

- A. The work of this Section shall be done by a firm specializing in this type of work. The firm shall:
 1. Regularly and presently perform shoring installation as one of their principal services.
 2. Have technical qualifications, experience, training, and facilities to properly install shoring.
 3. Provide the services of a supervising engineer, registered in the State, with at least 5 years of experience in the design and construction of shoring walls.

4. A foreman or superintendent experienced in the installation and removal shoring walls shall be present while this work is performed.

1.7 PERMITTING

- A. Secure all permits necessary to complete the requirements of this Section.

PART 2 PRODUCTS

2.1 GENERAL

- A. Materials and equipment shall be safe and in good condition and shall conform to local, state, and federal codes.

PART 3 EXECUTION

3.1 GENERAL

- A. Provide sheeting, shoring, and other protection and support systems wherever required, in accordance with current local, state, and federal laws, codes, and ordinances.
- B. The Contractor is solely responsible for excavation protection and worker safety.
- C. The Contractor shall be solely responsible for the protection of existing utilities and structures. Under no circumstance shall work threaten the integrity (physical and operational) of these utilities and/or structures.

3.2 EXCAVATION SUPPORT SYSTEMS

- A. The excavation support systems shall not disturb the state of soil adjacent to the trench or excavation and below the excavation bottom.
- B. Water control measures shall be provided at all times in accordance with the requirements specified in Section 31 23 19, Dewatering.
- C. The support system shall extend below the main excavation bottom elevation to a depth adequate to prevent hydrostatic uplift, seepage and piping, and lateral movement and to adequately support applied vertical loads.
- D. Damage to existing utilities or structures during installation of excavation support system shall be avoided. If damage occurs, it shall be repaired at no cost to the Owner and to the satisfaction of the utility owner.

- E. A company representative from the excavation support system shall be onsite during initial setup of the system. Install excavation support system in strict conformance with the representative's recommendations.

3.3 CONTINGENCY PLAN IMPLEMENTATION

- A. Excess movements or settlements: Work shall be stopped immediately and the causes of excess or detrimental movements evaluated if:
 - 1. Damage is noted to existing site features or surrounding properties.
 - 2. Shoring wall movements exceed the limits specified herein or per submitted calculations.
- B. Immediately notify the Engineer and begin the implementation of the approved contingency plan to mitigate the effects of settlement or movement occurred.

3.4 REMOVAL OF SUPPORT SYSTEMS

- A. Removal of excavation support systems shall be performed in a manner that does not disturb or damage adjacent new or existing structures or utilities.
- B. Fill all voids immediately with specified backfill material.
- C. All damage to property resulting from removal shall be promptly repaired at no cost to the OWNER. The Engineer shall be the sole judge as to the extent and determination of the methods and materials for repair.

3.5 SCHEDULE

- A. An internally braced excavation support system selected by the CONTRACTOR shall be provided for the excavation of the following structures, unless otherwise approved by the ENGINEER:
 - 1. Trenchless launch pit
 - 2. Trenchless receiving pit
 - 3. Excavation to abandon existing transmission mains intertie

END OF SECTION

SECTION 32 11 23 - AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes construction of an aggregate subbase and base course for placement under asphalt or concrete paving, unit paving, or placed and left exposed.
- B. Section Includes:
 - 1. Aggregate subbase.
 - 2. Aggregate base course.

1.2 RELATED REQUIREMENTS:

- A. Section 31 22 13 - Rough Grading
- B. Section 31 23 17 - Trenching
- C. Section 31 05 16 - Aggregates for Earthwork
- D. Section 32 12 16 - Asphalt Concrete Pavement

1.3 REFERENCE STANDARDS

- A. Standard Specifications:
 - 1. Where the term "Standard Specifications" is used, such reference shall mean the 2018 edition of the Oregon Department of Transportation (ODOT) Standard Specifications for Highway Construction.
 - 2. Where reference is made to a specific part of the Standard Specifications, such applicable part shall be considered as part of this section of the Specifications.
 - 3. In case of a conflict in the requirements of the Standard Specifications and the requirements stated herein, the requirements herein shall prevail.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
 - 2. T11, Standard Method of Test for Materials Finer Than 75 μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - 3. T27, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates.
 - 4. 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.

C. ASTM International (ASTM):

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 D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
4. ASTM D2940 - Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways or Airports.
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 DEFINITIONS

- A. Completed Course: Compacted, unyielding, free from irregularities and standing water, with smooth, tight, even surface, true to grade, line, and cross-section.
- B. Completed Lift: Compacted with uniform cross-section thickness.
- C. Keystone: Fine aggregate used to aid in binding of loose surface stone.

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 1. Submit data for geotextile fabric and herbicide.
- C. Materials Source: Submit name of aggregate materials suppliers.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.

PART 2 PRODUCTS

2.1 SHOULDER AGGREGATE

- A. Of the size shown on the Drawings.

- B. Coarse Aggregate: Type A1, Dense-Graded Aggregate as specified in Section 32 05 16, Aggregates for Earthwork.

2.2 DENSE-GRADED BASE AGGREGATES

- A. Of the size shown on the Drawings.
- B. Coarse Aggregate: Type A1, Dense-Graded Aggregate as specified in Section 32 05 16, Aggregates for Earthwork.

2.3 OPEN-GRADED BASE AGGREGATES

- A. Of the size shown on the Drawings.
- B. Coarse Aggregate: Type A2, Granular Drain Backfill Material as specified in Section 32 05 16, Aggregates for Earthwork.

2.4 SOURCE QUALITY CONTROL

- A. Perform tests necessary to locate acceptable source of materials meeting specified requirements.
- B. Final approval of aggregate material will be based on test results of installed materials.
- C. Should separation of coarse from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

2.5 EQUIPMENT

- A. Compaction Equipment: Adequate in design and number to provide compaction and to obtain specified density for each layer.

2.6 ACCESSORIES

- A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting subgrade.
- B. Verify compacted substrate is dry and ready to support paving and imposed loads.
 - 1. Proof roll substrate with equipment approved by the ENGINEER in minimum two perpendicular passes to identify soft spots.

2. Remove and replace soft substrate with compacted fill as determined via proof roll. Substrate shall be considered soft if any deflection is observed during proof roll.
- C. Subgrade Geotextile: Place between substrate and aggregate base course in accordance with manufacturer's recommendations.
- D. Do not place base course or surfacing materials in snow or on soft, muddy, or frozen subgrade.
- E. Obtain Engineer's acceptance of subgrade before placing base course or surfacing material.
- F. Verify compacted substrate is dry and ready to support paving and imposed loads.
 1. Proof roll substrate with equipment approved by the Engineer in minimum two perpendicular passes to identify soft spots.

3.2 HAULING AND SPREADING

- A. Hauling Materials:
 1. Do not haul over surfacing in process of construction.
 2. Loads: Of uniform capacity.
 3. Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection.
- B. Spreading Materials:
 1. Distribute material to provide required density, depth, grade, and dimensions with allowance for subsequent lifts.
 2. Produce even distribution of material on prepared surface without segregation.
 3. Should segregation of coarse from fine materials occur during placing, immediately change methods of handling materials to correct uniformity in grading.
 4. Maintain consistent gradation of material. Widely varying gradation will be cause for rejection.

3.3 CONSTRUCTION OF COURSES

- A. Untreated Aggregate Base Course:
 1. If the required compacted depth of the base course exceeds 6 inches, construct it in two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches.

2. Completed Course Total Thickness: As shown on the Plans, 8-inch minimum.
 3. Spread lift on preceding course to required cross-section. Place each layer in spreads as wide as practical and to the full width of the course before a succeeding layer is placed.
 4. Lightly blade and roll surface until thoroughly compacted.
 5. Add keystone to achieve compaction and as required when aggregate does not compact readily due to lack of fines or natural cementing properties, as follows:
 - a. Use 3/4-inch leveling course or surfacing material as keystone.
 - b. Spread evenly on top of base course, using spreader boxes or chip spreaders.
 - c. Roll surface until keystone is worked into interstices of base course without excessive displacement.
 - d. Continue operation until course has become thoroughly keyed, compacted, and will not creep or move under roller.
 6. Blade or broom surface to maintain true line, grade, and cross-section.
- B. Gravel Surfacing and Leveling Course:
1. Place shoulder aggregates in a single layer, or two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 9 inches.
 2. Spread on preceding course in accordance with cross-section shown.
 3. Blade lightly and roll surface until material is thoroughly compacted.
 4. Complete Total Thickness: As shown on the Plans, 8-inch minimum.

3.4 ROLLING AND COMPACTION

- A. Commence compaction of each layer of base immediately after spreading operations and continue until density of 95 percent of maximum density has been achieved as determined by AASHTO T99.
- B. Roll each layer of material until there is no appreciable reaction or yielding under the compactor before succeeding layer is applied.
- C. Shape and maintain the surface of each layer during compaction operations. Commence rolling at outer edges and continue toward center; do not roll center of road first.

- D. Apply water as needed to obtain specified densities.
- E. Place and compact each lift to the required density before succeeding lift is placed.
- F. Surface Defects: Remedy by loosening and rerolling. Reroll entire area, including surrounding surface, until thoroughly compacted.
- G. Finished surface shall be true to grade and crown before proceeding with surfacing.

3.5 SURFACE TOLERANCES

- A. Blade or otherwise work surfacing as necessary to maintain grade and cross-section at all times, and to keep surface smooth and thoroughly compacted.
- B. Finished Surface of Untreated Aggregate: Within plus or minus 0.04 foot of grade shown at any individual point.
- C. Overall Average: Within plus or minus 0.04 foot from crown and grade specified.

3.6 FIELD QUALITY CONTROL

- A. Quality control testing shall be performed by an independent testing laboratory provided by the Contractor.
- B. Refer to table below for minimum sampling and testing requirements for aggregate base course and surfacing. The OWNER reserves the right to complete additional testing.

Property	Test Method	Frequency	Sampling Point
Gradation	AASHTO T11 and AASHTO T27	One sample every 500 tons but at least every 4 hours of production	Roadbed after processing
Moisture Density (Maximum Density)	AASHTO T99	One test for every aggregate grading produced	Production output or stockpile
In-Place Density and Moisture Content	AASHTO T310	One for each 500 ton but at least every 10,000 square feet of area	In-place completed, compacted area

3.7 CLEANING

- A. Remove excess material from the Work area. Clean stockpile and staging areas of all excess aggregate. Restore per Specifications as applicable.

END OF SECTION

SECTION 32 12 16 - ASPHALT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Comply with the ODOT 2018 Oregon Standard Specifications for Construction modified as shown in this section.
- B. Comply with Section 00110 of the Oregon Standard Specifications, modified as follows:

00110.20 Definitions - Replace the definition for “Engineer” with the following:

Engineer – the Engineer refers to the Owner’s Representative

1.2 SUBMITTALS

- A. Aggregate Qualification Tests: In accordance with Standard Specifications Section 00640 for aggregate used in aggregate base.
- B. Aggregate Qualification Tests: In accordance with Standard Specifications Section 00744 for aggregate used in asphalt concrete.
- C. Job mix formula shall be an approved job mix formula. Submit formula, supplier, and product identification to the Engineer 30 days prior to start.
 - 1. Definite percentage for:
 - a. Each sieve fraction.
 - b. New asphalt cement.
 - c. Recycled asphalt pavement.
 - 2. Temperature of completed mix when discharged from mixer.
 - 3. Character and quantity of anti-strip and recycling agents.

SECTION 00730 - EMULSIFIED ASPHALT TACK COAT

Comply with Section 00730 of the Standard Specifications modified as follows:

00730.90 Payment - Replace this subsection, except for the subsection number and title, with the following:

No separate or additional payment will be made for Emulsified Asphalt tack coat.

00744 – ASPHALT CONCRETE PAVEMENT

Comply with Section 00744 of the Standard Specifications modified as follows:

00744.10(c)(1) Processing Shingles - In the paragraph that begins "Process the RAS by grinding...", replace the words "AASHTO T 2" with the words "AASHTO R 90".

00744.11(a) Asphalt Cement - Add the following to the end of this subsection:

Provide PG70-22ER grade asphalt cement for this Project.

00744.44(b) Drop-Offs: Replace the bullet that begins "Construct, maintain, remove, and dispose ..." with the following bullet:

- Construct, maintain, remove, and dispose of the temporary wedge at no additional cost to the Agency. ACP for the temporary wedge will be paid for at the Contract unit price.

00744.51 Opening Sections to Traffic - Schedule work so that, during the same shift, the surfaces being paved are paved full width and length through the wearing Course before opening to traffic.

END OF SECTION

SECTION 32 12 17 - COLD PLANE PAVEMENT REMOVAL

PART 1 GENERAL

1.1 SUMMARY

- A. Comply with the ODOT 2018 Oregon Standard Specifications for Construction modified as shown in this section.
- B. Comply with Section 00110 of the Oregon Standard Specifications, modified as follows:

00110.20 Definitions - Replace the definition for “Engineer” with the following:

Engineer – the Engineer refers to the Owner’s Representative

00620 – COLD PLANE PAVEMENT REMOVAL

Comply with Section 00620 of the Standard Specifications modified as follows:

00620.43 Maintenance Under Traffic - Replace this subsection, except for the subsection number and title, with the following:

Traffic is not allowed on the cold planed surface. Before opening the area to traffic, pave the surface according to 00744.51.

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

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. Contractor's Proposed Maintenance Plan.

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. Organic Material

1. Peat: A natural material formed by the decomposition of reeds, sedges, or mosses from freshwater sites. Peat shall be free from lumps, roots, or stones, and organic matter shall be not less than 90 percent on a dry weight basis.
2. Rotted Sawdust: Nitrogen stabilized, 1/4-inch minus, clean sawdust or shavings, free from weed seed, and containing no chemicals or materials harmful to plant life.
3. Manure: Well-rotted stable or cattle manure, reasonably free from weed seed and refuse, containing no chemicals or materials harmful to plant life. Manure shall be no less than 2 months or more than 1 year old. Sawdust and shavings shall not exceed 50 percent content of manure.
4. Mushroom Compost: Spent mushroom growing compost.

B. Sand

Clean, coarse, ungraded sand, meeting the requirements of ASTM C 33 for fine aggregate.

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. Native Grasslands Seed Mix, as provided by Sunmark Seeds International, Inc., or approved equal.

1. Seed shall be certified, blue tag, clean, delivered in original, unopened packages bearing an analysis of the contents, guaranteed 95% pure and to have a minimum germination rate of 95% in one year.

2. The following seed mix shall be applied to areas disturbed by the Contractor along the alignment and north of the reservoir.

Seed Mix	Minimum Application Rate, lbs/acre
Blue wildrye (<i>Elymus glaucus</i>)	17.39
California brome (<i>Bromus carinatus</i>)	17.39
Native Red Fescue (<i>Festuca rubra rubra</i>)	6.52
Tufted Hairgrass (<i>Deschampsia cespitosa</i>)	2.17

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, Sentinell 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. All seeding shall be completed by hydroseeding. Add mulch and thoroughly mix with water prior to adding seed. Place the fertilizer in the hydroseeder tank no more than 30 minutes prior to application. Apply or spray the area thoroughly saturating the soil.
- B. 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.
- C. Apply seed mixes per supplier's recommendations.

3.5 INSPECTIONS

- A. The work will be inspected for coverage and rate during placement.

END OF SECTION

SECTION 33 05 13 - MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes cast-in-place and precast concrete manholes and covers for access to subsurface utilities.
- B. Section Includes:
 - 1. Modular precast concrete manhole with tongue-and-groove joints with precast transition to cover frame, covers, anchorage, and accessories.
 - 2. Bedding and cover materials.

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 33 11 10 – Water Utility Distribution and Transmission Piping
- F. Section 33 41 10 - Storm Utility Drainage Piping.

1.3 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO M-198B – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
- B. American Concrete Institute:
 - 1. ACI 301 – Building Code Requirements for Structural Concrete.
 - 2. ACI 315 – Details and Detailing of Concrete Reinforcement.
 - 3. ACI 318 – Building Code Requirements for Structural Concrete.
- C. ASTM International:
 - 1. ASTM A48 - Standard Specification for Gray Iron Castings.
 - 2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

4. ASTM C55 - Standard Specification for Concrete Building Brick.
 5. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).
 6. ASTM C150 - Specifications for Portland Cement.
 7. ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar.
 8. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
 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 C827 – Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
 12. ASTM C913 - Standard Specification for Precast Concrete Stormwater and Wastewater Structures.
 13. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
 14. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
- D. Federal Specifications:
1. SS-S-00210 (210-A) – Specification for Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.
- E. US Army Corp of Engineers:
1. CRD-C 621 – Specifications for Non-Shrink Grout.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
1. Pre-cast concrete manholes:
 - a. Design criteria and calculations.
 - b. Details of reinforcement.

2. Steps.
 3. Cover and frame construction, features, configuration, dimensions and material specifications.
 4. Rubber gaskets.
 5. Grout and mortar.
- C. Shop Drawings:
1. Indicate manhole by location.
 2. Provide dimensions, elevations, joints, location and type of lifting inserts.
 3. Indicate connecting piping material, piping size, piping connection angles and offsets, and sizes of penetrations.
- D. Manufacturer's Certificate: Certification 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.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Comply with precast concrete manufacturer's instructions and ASTM C913 for unloading, storing, and moving precast manholes and drainage structures.
- C. Storage:
1. Store precast concrete manholes as to prevent damage to Owner's property or other public or private property.
 2. Repair property damaged from materials storage.

PART 2 PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA FOR MANHOLES

- A. Equivalent strength: Based on structural design of reinforced concrete as outlined in ACI 318.

- B. Design of Lifting Devices for Precast Components: According to ASTM C913.
- C. Design of Joints for Precast Components:
 - 1. According to ASTM C913.
 - 2. Lipped male/female joints.
 - 3. Maximum Leakage: 0.025 gal. per hour per foot of joint at 3 feet of head.
- D. Shaft Construction:
 - 1. Reinforced concrete.
 - 2. Concentric with concentric cone top section
 - 3. Sleeved to receive pipe connections.
- E. Wall Thickness:
 - 1. Minimum wall thickness shall be 5 inches.
 - 2. Cones shall have the same wall thickness and reinforcement as riser sections.
- F. Shape: Cylindrical.
- G. Clear Inside Dimensions:
 - 1. As indicated on Drawings.
 - 2. Sections shall consist of circular sections in standard nominal inside diameters of 42, 48, 54, 60, 72, 84, 96, 108, 120, 132, or 144 inches.
- H. Design Depth:
 - 1. As indicated on Drawings.
- I. Clear Cover Opening: As indicated on Drawings, minimum of 30 inches.
- J. Pipe Entry: Furnish openings as required and as indicated on the Drawings.
- K. Steps:
 - 1. Rungs:
 - a. Material: Formed polypropylene with 1/2-inch diameter, Grade 60 reinforcing bar.
 - b. Comply with ASTM C478.
 - c. Reinforcing bar to comply with ASTM A615.
 - 2. Formed integral with manhole sections.
 - 3. Width: Minimum 12 inches.

4. Spacing: 12 inches o.c. vertically.

2.2 MANHOLES

A. Precast Concrete Manholes:

1. Sections:

- a. Description: Reinforced precast concrete according to ASTM C478.
- b. Gaskets: According to ASTM C923.
- c. Heights: Multiples of 6 inches.

2. Bases:

- a. Base slab integral with sidewalls.
- b. Monolithic construction, conforming to ASTM C478.

B. Cast-in-Place Concrete Manholes:

1. Sections: Reinforced cast-in-place concrete as specified in Section 03 30 00 - Cast-in-Place Concrete.
2. Concrete forming in accordance with Section 03 10 00, Concrete Work.

C. Joint Materials:

1. Mortar:

- a. Conform to ASTM C387.
- b. Admixtures
 - 1) Allowable, not exceeding the following percentages of weight of cement:
 - a) Hydrated lime, 10 percent;
 - b) Diatomaceous earth or other inert materials, five (5) percent;
- c. Consistency: Shall be such that it will readily adhere to the precast concrete if using the standard tongue and groove type joint.
- d. Mortar not used within 30 minutes of initial mixing shall be discarded and not be used.

2. Non-Shrink Grout:

- a. Description: Non-metallic, cementitious, commercial grout exhibiting zero shrinkage per ASTM C827 and CRD-C-621.
- b. Manufacturers:
 - 1) Preco-Patch;

- 2) Sika 212;
 - 3) Euco N-S;
 - 4) Five-Star;
 - 5) Approved equal
3. Grout shall not be amended with water after initial mixing.
4. Grout not used within 20 minutes of initial mixing shall be discarded and not be used.
5. Commercial Concrete Bonding Agent:
 - a. Non-shrink grout shall be placed or packed only with the use of an approved commercial concrete bonding agent applied to all cured concrete surfaces being grouted.
 - b. Bonding agent shall be compatible with the brand of grout used.
 - c. Water shall not be used as a substitute for the commercial bonding agent.
- D. Preformed mastic gaskets for manhole joints shall meet Federal Specifications SS-S-00210 (210-A), AASHTO M-198B and ASTM C990.
- E. Reinforcement:
 1. Formed steel wire.

2.3 FRAMES AND COVERS

- A. Description:
 1. Construction: ASTM A48, Class 30B cast iron.
 2. Lid:
 - a. Machined flat bearing surface.
 - b. Removable.
 3. Cover Design: Closed.
 4. Live Load Rating: AASHTO H20 loading.
 5. Cover: Molded with "S" cast in.
 6. Coefficient of Friction on Outside Face: Minimum of 0.60.

2.4 RISER RINGS

- A. Description:

1. 4 Inches to 6 Inches Thick:
 - a. Material: Precast concrete.
 - b. Comply with ASTM C478.
2. Less than 4 Inches Thick:
 - a. Material: Cast iron.
 - b. Comply with AASHTO M306.
3. Rubber Seal Wraps:
 - a. Wraps and Band Widths: Conform to ASTM C877, Type III.
 - b. Cone/Riser Ring Joint: Minimum 3 inches overlap.
 - c. Frame/Riser Ring Joint: 2 inches overlap.
 - d. Additional Bands: Overlap upper band by 2 inches.

2.5 MATERIALS

A. Bedding and Cover:

1. Bedding: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.
2. Backfill Around Structure: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.
3. Soil Backfill from Above Pipe to Finish Grade:
 - a. In existing or future roadways, right-of-way:
 - 1) Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.
 - b. In non-paved areas outside of footprint of existing or future structures, outside of right-of-way:
 - 1) Soil Type S1, as specified in Section 31 05 13, Soils for Earthwork.
 - 2) Subsoil: No rocks over 6 inches in diameter, frozen earth, or foreign matter.

2.6 FINISHES

A. Steel:

1. Galvanizing:

- a. ASTM A123.
- b. Hot dip galvanize after fabrication.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify items provided by other Sections of Work are properly sized and located.
- B. Verify built-in items are in proper location and ready for roughing into Work.
- C. Verify correct size of manhole excavation.

3.2 PREPARATION

- A. Design the method of placement for all precast items and add all reinforcing steel, embeds, bracing and other items necessary for placement. All portions of embeds which remain embedded in the concrete shall be made of stainless steel.
- B. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on Drawings to indicate its intended use.
- C. Coordinate placement of inlet and outlet pipe or duct sleeves required by other Sections.
- D. Do not install manholes where site conditions induce loads exceeding structural capacity of manhole components.
- E. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage; remove and replace damaged units.
- F. Subgrade
 - 1. Subgrade shall be compacted to 95 percent of maximum density.
 - 2. Compacted subgrade shall be covered with a minimum of six (6) inches of aggregate base compacted to 95 percent of maximum density, extending a minimum of six (6) inches beyond the outside limits of the manhole, unless otherwise indicated on Drawings.
 - 3. Grade the aggregate base to a uniform, level surface which will fully support the structure and to an elevation that will ensure proper positioning of the top slab or lid.

3.3 INSTALLATION

- A. Excavation and Backfill:
 - 1. Excavate manholes as specified in Section 31 23 16, Excavation in location and to indicated depth.
 - 2. Provide 12 inches of clearance around sidewalls of structure for construction operations.
 - 3. When groundwater is encountered, prevent accumulation of water in excavations; place manholes in dry trench.
- B. Where possibility exists of watertight structure becoming buoyant in flooded excavation, anchor structure to avoid flotation as approved by Engineer.
- C. Base Pad:
 - 1. Place base pad.
 - 2. Trowel top surface level.
- D. Backfill excavations for manholes as specified in Section 31 23 23, Fill.
- E. Form and place manhole cylinder plumb and level and to correct dimensions and elevations.
- F. Grout base of shaft sections to achieve slope to exit piping, trowel smooth, and contour to form continuous drainage channel.
- G. Set cover frames and covers level without tipping and to correct elevations.
- H. Coordinate with other Sections of Work to provide correct size, shape, and location.
- I. Precast Concrete Manholes:
 - 1. Assembly:
 - a. Install precast structures in accordance with the manufacturer's recommendations unless otherwise required by the Contract Documents.
 - b. Verify installed manholes meet required alignment and grade.
 - c. Lift precast components at lifting points designated by manufacturer.
 - d. When lowering manholes into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
 - e. Set precast structures bearing firmly and fully on crushed stone bedding, compacted as specified in Section 31 23 23, Fill or on other support system as indicated on Drawings.

- f. Assemble multi-section structures by lowering each section into excavation; set level and firmly position base section before placing additional sections.
 - g. Place manhole sections plumb and level, trim to correct elevations, and anchor to base pad.
 - h. Remove foreign materials from joint surfaces and verify sealing materials are placed properly.
 - i. Maintain alignment between sections by using guide devices affixed to lower section.
2. Joints:
- a. Sealing materials may be installed onsite or at manufacturers plant.
 - b. All joints shall be sealed watertight by the use of rubber gaskets or other approved preformed sealant.
 - c. All joints shall then be filled with non-shrink grout on both the inside and outside surfaces to produce smooth interior and exterior surfaces.
3. Concrete Base Installation:
- a. Bases shall be set at the proper grade to allow pipe openings to match the grades for connecting pipes.
 - b. Invert shall be constructed to a section identical with that of the sewer pipe.
 - c. Where the size of sewer pipe is changed at the manhole, the invert shall be constructed to form a smooth transition without abrupt breaks or unevenness of the invert surfaces.
 - d. Prevent sewage or water from contacting the new concrete or mortar surfaces to prevent damage to the fresh concrete or mortar until the initial set has been achieved.
 - e. Manhole bases shall be set level so base gravel fully and uniformly supports them in true alignment with uniform bearing throughout full circumference.
 - f. Do not level the base sections by wedging gravel, or other material, under the edges.
 - g. Flexible connectors shall be installed in the base section to form a permanently watertight seal.

4. Manhole Riser Sections:

- a. Precast manhole components may be used to construct standard, drop and carry-through manholes. Manholes less than four (4) feet in depth measured from the spring line of the pipe to the bottom of the lower riser ring shall be flat-top manholes.
- b. Install manhole riser sections at the location shown on the plans. All sanitary sewer and pollution control manholes joints shall be watertight and shall use rubber gaskets or a preformed sealant. All joints shall then be filled with non-shrink grout inside and out so as to produce smooth interior and exterior surfaces. All manhole penetrations shall be watertight. Complete manholes shall be rigid. Compact backfill in accordance with the provisions stated elsewhere in this document.
- c. All lift holes shall be thoroughly wetted, completely filled with mortar, and smoothed and pointed both inside and out to ensure watertightness.
- d. The shortest length of riser section to be incorporated into the manhole shall be installed immediately below the flat slab top or cone.
- e. Properly locate and plumb each manhole riser section.
- f. Install manhole extensions and top slabs in accordance with manufacturer's specifications and as shown on the plans. Lay section risers with the sides plumb and the tops level. Make joints and penetrations watertight.
- g. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.

5. Entrances / Exits:

- a. Cut pipe flush with interior of structure.
- b. Shape inverts through manhole as indicated on Drawings.
- c. All rigid non-reinforced pipe entering or leaving the manhole (new or existing manhole) shall be provided with flexible joints within one (1) foot of the structure and shall be placed on compacted bedding.
- d. Ribbed HDPE pipe connections shall be grouted watertight with non-shrink grout.
- e. PVC pipe shall be connected to manholes using an approved adapter specifically manufactured for the intended service.
 - 1) Adapters shall be Fernco, Kor-N-Seal, or approved equal.

6. Grates, Frames, and Covers:

- a. Manhole frames, grates and covers shall be installed in such a manner as to prevent infiltration of surface or groundwater between the frame and the concrete of the manhole section. Use preformed rubber ring to form a watertight seal.
- b. Manhole frames and covers shall be installed to grades shown on the drawings or as directed.
- c. Adjustment of manhole castings shall be made using specified precast grade rings and approved rubber ring joints.
- d. The maximum depth of adjustment below any manhole casting shall be 16 inches, and a minimum depth of adjustment shall be four (4) inches.

3.4 FIELD QUALITY CONTROL

- A. Test concrete manhole and structure sections according to ASTM C497.
- B. Perform manhole testing according to Section 33 01 30.13, Sewer and Manhole Testing.
- C. Test cast-in-place concrete as specified in Section 03 11 00, Concrete Work.
- D. Vertical Adjustment of Existing Manholes:
 1. If required, adjust top elevation of existing manholes to finished grades as indicated on Drawings.
 2. Reset existing frames, grates, and covers that were carefully removed and cleaned of mortar fragments to required elevation according to requirements specified for installation of castings.
 3. When removal of existing concrete wall is required, remove concrete without damaging existing vertical reinforcing bars, clean concrete from vertical bars, and bend into new concrete top slab or splice to required vertical reinforcement as indicated on Drawings.
 4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete as specified in Section 03 11 00, Concrete Work.

END OF SECTION

SECTION 33 05 23 - TRENCHLESS UTILITY INSTALLATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work under this Section includes all labor, equipment and materials required for constructing cased crossings by trenchless (tunneling/boring/jacking) installation methods. The Contractor shall furnish and install steel casings, carrier pipes, sand fill of the annular spaces within casing, grout voids around the outside of casings, and casing end seals, complete and in place, all in accordance with these provisions.

1.2 RELATED SECTIONS

- 1. Section 31 05 13 - Soils for Earthwork.
- 2. Section 31 05 16 - Aggregates for Earthwork.
- 3. Section 31 23 16 - Excavation.
- 4. Section 31 23 19 - Dewatering.
- 5. Section 31 50 00 – Excavation Support and Protection
- 6. Section 33 11 10 - Water Utility Distribution & Transmission Piping.
- 7. Supplementary Information: Geotechnical Memorandum; bore hole location and findings of subsurface materials.
- 8. Supplementary Information: Utility Potholing Data; existing utility crossing depths, pipe sizes, etc.

1.3 DEFINITIONS

- A. Annular Space: The void between the outside diameter of a carrier pipe and the inside surface of the casing previously installed by tunneling, boring or jacking.
- B. Backfill Space: The void created between the extreme outer limit of excavation and the outside diameter of a casing or pipe being jacked into place.
- C. Boring and Jacking: A trenchless method of underground pipe construction wherein a pipe or series of pipe sections is pushed into place while excavation is performed at the head of the pipe string.
- D. Boring Equipment: Tunnel boring machine, which includes: the boring head, mechanical shield, digger head, or other excavation equipment located at face of a jacked pipe or casing, including all excavation support and muck handling equipment and equipment used for any pipe insertion, placement, and backfill.
- E. Carrier Pipe: A permanent material-carrying pipe installed by insertion into a casing pipe.

- F. Casing: A pipe or other conduit jacked into place in a boring and jacking operation, which provides initial ground support for pipe insertion.
- G. Full Face Control: Complete support and control of the excavation face at all times for all loading conditions throughout the course of a boring and jacking operation.
- H. Boring through Unclassified Material: With respect to tunneling, boring and jacking, the above term is defined as all excavation, regardless of type, character, composition or condition of the material encountered and shall further include all debris, junk, broken concrete, and all other material. All excavation shall be unclassified unless provided for otherwise elsewhere in these Specifications.
- I. Boring through Rock: With respect to tunneling, boring and jacking, the above term is defined as the removal of rock by systematic and continuous drilling and splitting, or the necessary use of special rock cutting heads as demonstrated to the Owner's Representative for rock removal. Rock is defined as material which, by actual demonstration, cannot be reasonably excavated with standard equipment and shall be considered where 50 percent or more of the cross-sectional face requires removal as described above. The above term shall be understood to indicate a method of removal and not a geological formation.
- J. Boring through Transitional Material: With respect to tunneling, boring and jacking, the term "Boring through Rock" is defined as the removal of rock by systematic and continuous drilling and splitting. Transitional material is defined as material which, by actual demonstration, cannot be reasonably excavated with standard equipment and shall be considered where 50 percent or less of the cross-sectional face requires removal as described above. The above term shall be understood to indicate a method of removal and not a geological formation.

1.4 MEASUREMENT AND PAYMENT

- A. The Plans and these Specifications indicate a specific type (tunneled/bored/jacked or open trench), size, wall thickness and other required characteristics of casing to be installed at each cased crossing. The Contractor may propose to install casing types and sizes other than those specified on the Plans and in these Specifications; however, no changes will be allowed without the prior approval of the Owner's Representative.
- B. If the Contractor receives approval by the Owner's Representative to install casing types and sizes other than those specified on the Plans and in these Specifications, it is the Contractor's responsibility to ensure casing types and sizes are fully compatible with project constraints, including traffic control, project work limits, roadway and utility system shut down requirements, work hour limitations, and adjacent structures.

- C. Measurement and payment for Work shall be made for the size and type of casing identified on the Plans only, regardless of any Owner's Representative-approved changes.
- D. Similarly, if the Contractor proposes bore pit locations or sizes other than those identified on the Plans, the Contractor must obtain prior approval of the Owner's Representative and will be responsible to ensure that the proposed pits are fully compatible with project constraints and permit provisions.

1.5 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Comply with the provisions of the latest versions of the following Codes, Specifications and Standards, except as otherwise shown or specified.
- B. The following is a list of standards which may be referenced in this Section:
 - 1. ASTM International (ASTM):
 - a. A252, Standard Specification for Welded and Seamless Steel Pipe Piles.
 - 2. American Water Works Association (AWWA):
 - a. C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - b. C151, Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
 - c. C200, Standards for Steel Water Pipe (6 inches and larger).
 - d. C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.
 - 3. American Welding Society (AWS):
 - a. D1.1, Structural Welding Code.
 - 4. National Utilities Contractors Association (NUCA):
 - a. Guide to Pipe Jacking and Microtunneling.
 - b. Trenchless Assessment Guide.

1.6 SUBMITTALS

- A. Work Plan:
 - 1. General description of approach to the tunneling/boring/jacking process for installation of the casing(s).
 - 2. Site plan to identify site constraints, staging areas and location(s) of tunneling/boring/jacking pits or approach trenches.

3. Proposed contingency plans for any critical or particularly dangerous phases of boring and jacking operation.
4. General description of the equipment to be used on the Work, with specific information focused on the tunneling/boring/jacking equipment.
5. Detail method of steering and methods of minimizing over excavation and loss of ground during casing installation, especially when excavating cobbles and boulders.
6. Sample of log to be used in monitoring and recording daily excavation volumes versus face advancement.
7. Methods for Controlling Grade:
 - a. Details and description of proposed guidance equipment, method of line and grade control, and proposed frequency of line and grade checking.
 - b. Proposed method of bringing actual casing alignment and elevation back onto specified line and grade in the event of installation deviating from designed line and grade.
8. Casing Materials List: Including diameter, wall thickness, and type of steel casing pipe designed for external forces and jacking forces.
9. Written report results of visual check of entire length of casings prior to installation of carrier pipe to verify there are no voids or defective joints.
10. Casing Spacers: Size, type, materials of construction and spacing. Provide calculations and drawings for factory-designed casing spacers.
11. A description of the process to perform external grouting around the casing including installation equipment, procedures and grout mix design. Include injection points and method of monitoring and controlling fill pressure for each of the required filling operations.
12. Casing welding procedures and welder certificates.
 - a. Welding procedures and welding operators shall be in accordance with requirements of AWS D1.1 "Standard Qualification Procedure"
13. Plan for preventing loss-of-ground or settlement during all casing installation and related work.
 - a. Include method for monitoring surface settlement of existing ground above the casing alignment during all casing installation and related work.

- b. The minimum number of settlement monitoring points shall be at least at quarter stations along the centerline of the boring and jacking alignment. Settlement points at either side of the centerline points shall also be installed as needed or directed by the Owner's Representative.
- 14. Certified affidavits of compliance for all pipe and other products or materials furnished under this Section which shall include the physical and chemical properties of all steel.
- 15. Dewatering Plan: Show location, size, and layout of pumps, wells, piping, appurtenant equipment, and points of discharge and disposal to be used to keep excavations free of water. Conform to dewatering requirements set forth in Section 31 23 19, Dewatering.
- 16. Emergency response procedures to handle situations when Work is compromised and jeopardizes safety or integrity of installation.
- 17. Proposed method of installing sand within annular space, including means for verifying no voids between the carrier pipe and casing remain.

1.7 PREINSTALLATION MEETINGS

- A. The Contractor shall organize, run and attend a pre-installation meeting to be held a minimum of two weeks prior to commencing the Work.
- B. The Contractor shall discuss with the Owner's Representative plans for the installation of the Work, provide and discuss contingency plans, utility coordination, excavation and shoring, casing installation and all other aspects of the Work as required in this Section.

1.8 QUALITY ASSURANCE

- A. The Contractor shall give the Owner's Representative and right-of-way owner at least seven (7) days advance notice prior to the start of any excavation.
- B. All Work shall be performed in the presence of the Owner's Representative, unless the Owner's Representative has granted prior approval to perform such work in their absence.
- C. Perform all Work in accordance with NUCA's Standards referenced herein.
- D. Welding:
 - 1. All shop and field welding procedures used to fabricate steel casings shall be prequalified under the provisions of ANSI/AWS D1.1.

2. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or special welds for pipe cylinders, casing joint welds, reinforcing plates and grout coupling connections.
3. All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the type of materials, welds, and positions to be used.
4. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local, approved testing agency prior to commencing Work on the casing or pipeline. Machines and electrodes similar to those used in the Work shall be used in qualification tests.
5. The Contractor shall furnish all materials and bear the expense of qualifying welders.

1.9 SAFETY

- A. It shall be the Contractor's responsibility to see Work is done in conformance with all applicable Federal, State, and local safety requirements.
- B. The Contractor is fully responsible and obligated to use procedures that assure the safety of all workers and equipment involved in the project, other project personnel, the public, and the adjacent property, whether public or private.

1.10 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this Section with minimum five (5) years' documented experience.
- B. Installer shall have experience with installations similar in size, type and scope as the Work specified herein and as shown on the Plans.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings and maintain in place until installation.
- C. Protect piping systems from entry of foreign materials and water by installing temporary covers, completing sections of Work, and isolating parts of completed system.
- D. Use wooden shipping braces between layers of stacked pipe.

- E. Stack piping lengths no more than three layers high.
- F. Store field joint materials in original shipping containers in dry area indoors.
- G. Support casing and carrier pipes with nylon slings during handling.
- H. Field Measurements:

1.12 DEFINITIONS

- A. Boring Through Unclassified Material: With respect to tunneling, boring and jacking, the above term is defined as all excavation, regardless of type, character, composition or condition of the material encountered and shall further include all debris, junk, broken concrete, and all other material. All excavation shall be unclassified unless provided for otherwise elsewhere in these specifications.
- B. Boring Through Rock: With respect to tunneling, boring and jacking, the above term is defined as the removal of rock by systematic and continuous drilling and splitting, or the necessary use of special rock cutting heads as demonstrated to the ENGINEER for rock removal. Rock is defined as material which, by actual demonstration, cannot be reasonably excavated with standard equipment and shall be considered where 50 percent or more of the cross-sectional face requires removal as described above. The above term shall be understood to indicate a method of removal and not a geological formation.
- C. Boring Through Transitional Material: With respect to tunneling, boring and jacking, the above term is defined as the removal of rock by systematic and continuous drilling and splitting. Transitional material is defined as material which, by actual demonstration, cannot be reasonably excavated with standard equipment and shall be considered where 50 percent or less of the cross-sectional face requires removal as described above. The above term shall be understood to indicate a method of removal and not a geological formation.

1.13 EXISTING CONDITONS

- A. Verify invert elevations of existing work or utilities prior to excavation and installation of Casing.
- B. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 GENERAL

- A. Use the types of materials as designed and specified herein for all required cased crossing construction.

2.2 CASING AND JACKING PIPE

- A. Tunneled/bored/jacked casings shall be smooth welded unlined steel pipe.
- B. Performance and Design Criteria:
 - 1. Design bracing and backstops and use jacks of sufficient rating for continuous jacking without stopping, except to add pipe sections and to minimize tendency of ground material to freeze around casing pipe.

2.3 STEEL CASING PIPE

- A. Steel casings shall conform to ASTM A252, Grade 3, or approved equal.
- B. Steel casing pipe shall have a minimum wall thickness of 1/2-inch and the minimum diameter as shown on the Plans or as specified herein.
- C. Steel casing pipe shall be furnished with bevels as required per AWS D1.1 for prequalified welds.
- D. Regardless of the minimum wall thicknesses shown on the Plans or specified herein, it shall be the Contractor's responsibility to provide casings of adequate strength and wall thickness capable of withstanding all loads which may be imposed including ground and hydrostatic loads, jacking stresses, slurry and grout pressures, external loads such as construction equipment, stockpiles, railroads, highway traffic, dams, and any other loads that may be anticipated.
- E. Joints:
 - 1. Steel casing shall be fabricated in sections with full circumference field butt welded joints according to AWS D1.1 to withstand excavation forces. The ends shall meet AWWA C200 requirements for beveled ends for field butt welding. Bevels shall be 30 degrees + 5 degrees/- 0 degrees and with a width of root face of 1/16th inch +/- 1/32 inch.
 - 2. It shall be the Contractor's responsibility to provide joints capable of withstanding jacking stresses.

3. Interior casing welds should be smooth not to impact spacer or skids on carrier piping.
- F. Injection Nipples: Equip casing with steel grout nipples for pressure grouting outside void around casing.
1. Prior to installation of the casing, weld steel grout nipples, at least 2 inches in diameter, on the inside of the casing.
 2. Provide nipples at 10-foot intervals, maximum.
 3. Provide additional nipples at locations of encountered obstructions and at encountered voids noted and recorded during casing installation.
 4. Located as follows:
 - a. Spring line on both sides of casing;
 - b. At Crown;
 - c. Additional locations as required to fill noted void areas.

2.4 CARRIER PIPE

- A. Carrier pipe shall be ductile iron piping as specified Section 33 11 10, Water Utility Distribution Piping and as shown on the Plans.

2.5 CASING SPACERS

- A. All carrier pipe shall be installed with casing spacers banded to it for guides and support as shown on the Plans.
- B. Insulators shall be sized to fit and attach to the carrier pipe without damaging materials, including any identified special coatings.
- C. Spacers shall be a minimum of 12 inches wide.
- D. Spaces shall be constructed with fusion-bonded epoxy coated steel bands and reinforced insulating runners.
- E. Spacers shall be multi-segmented to attach firmly around the pipeline.
- F. Spacers shall be fabricated for a centered and restrained configuration of the carrier pipe.
- G. Spacer risers:

1. Sized to provide for clearance of the carrier pipe bell couplings or retainer glands with a minimum ½-inch and not more than 1-1/2 inches of clearance from the top skids to the inside top of the casing.
 2. Each casing spacer shall have a minimum of four (4) spacer riser and runner assemblies with a minimum of two (2) risers on top and two (2) risers on the bottom.
- H. All nuts and bolts shall be corrosion-resistant stainless steel.
- I. Manufacturer:
1. M-12-FCE Series, as manufactured by Calpico, Inc.
 2. CSC-12 Series as manufactured by CCI pipeline Systems.
 3. Or approved equal.

2.6 CEMENT GROUT FOR GROUTING OF VOIDS AROUND CASINGS

- A. A mix of cementitious material, sand, and water which will reach a minimum ultimate strength of at least 100 psi.
- B. Mix design shall be (by weight) a minimum of 22% cementitious material consisting of cement and fly ash (75% maximum fly ash content of cementitious material), 69% of clean, well-graded sand, and 8% water.
- C. Air entrainment additives may be added up to 3 ounces per 100 pounds of cementitious material.
- D. Target slump shall be 6 inches.

2.7 CASING END SEALS

- A. Unless otherwise specified, casing end seal shall be a 12-inch thick grout bulkhead as shown on the drawings.
- B. Manufacturers:
1. Type C as manufactured by PSI.
 2. Model C as manufactured by Calpico.
 3. Approved equal.
- C. SAND
1. For filling of annular space between carrier pipe and interior of casing.
 2. Medium sand as specified in Table 310516-C of Section 31 05 16, Aggregates for Earthwork.

PART 3 EXECUTION

3.1 GENERAL

- A. Unless otherwise provided, the Contractor shall furnish and install all fittings, closure pieces, jointing materials and all appurtenances as shown in the Plans and as required to provide a complete and workable installation. All fabrication and testing shall comply with the requirements listed herein.
- B. The Contractor's attention is directed to the Plans, which show the close proximity of adjacent structures and utilities to the proposed tunneling/boring/jacking and casing areas. The Contractor shall be responsible for providing all shoring as may be required to maintain a safe excavation and shall at all times provide sufficient support and protection for existing structures and utilities. The Contractor shall keep the size of tunneling/boring/jacking pits to a minimum consistent with the requirements of the installations.
- C. The Contractor shall carefully study the Plans and Specifications applicable to the Work involved, contact the Owner's Representative regarding any potential irregularities or difficulties, and become familiar with the conditions, nature of excavations, and difficulties involved with installing casings, carrier pipes and related work.
- D. Failure on the part of the Contractor to properly assess the factors, conditions and difficulties involved in the performance of the Work will not entitle extra compensation of any kind, nor relieve any obligation of the Contractor for executing all details of the work as specified and planned. The Contractor shall assess tunneling/boring/jacking pits.
- E. Prior to demobilizing the tunneling/boring/jacking equipment from the project, the Contractor shall verify the installed casings are of sufficient length to facilitate construction of all drawing details. The Plans identify the minimum approximate casing length only. It is solely the Contractor's responsibility to field verify that the casing ends terminate at a location which will facilitate the construction of all drawing details.
- F. The Contractor shall monitor surface settlement of existing ground above the casing alignment during all casing installation and related work.
- G. If the Contractor is not ready to place the carrier pipe in the casing upon completing the casing installation, the casing ends shall be bulkheaded. In addition, all trenches and pits in public streets, private property, and within City, County or State right-of-way shall be backfilled, temporary or permanent surfacing placed thereon, and the affected area reopened to traffic, as necessary.

- H. The Contractor shall be responsible for maintaining the specified line and grade of the casing and carrier pipe within the specified tolerances of this Section or as shown on the Plans.

3.2 INSTALLATION

- A. Dewatering:

- 1. Install and maintain in accordance with Section 31 23 19, Dewatering.

- B. Pits or Approach Trenches:

- 1. Excavate pits or approach trenches according to approved Work Plan and as site conditions require.
 - 2. Ensure casing entrance faces as near perpendicular to alignment as conditions permit.

- C. Line and Grade:

- 1. Install casings to true line and grade.
 - 2. Allowable deviation from the true line and grade shall be no greater than ½-inch for line and ¼-inch for grade per 100 feet of centerline length, unless noted otherwise in the Plans.
 - 3. Utilize a laser and target system, water levels, surveys or other approved methods to continuously monitor line and grade during manned boring or tunneling operations.
 - 4. Check line and grade daily, every 40 feet or at intervals proposed in accepted submittals.
 - 5. Calibrate and maintain equipment in good working conditions throughout work operations.
 - 6. Should any deviation from true line and grade occur, modify the installation operation to correct the deviation.

- D. Boring and installation of casing shall occur in one continuous time frame, unless otherwise noted or approved by Owner's Representative.

- 1. The entire bored hole shall be cased at all times.
 - 2. Provisions shall be made to prevent soil sloughing, free flow of soft or loose materials, free flow of groundwater, or settlement occurring at the leading end of the tunneling/boring/jacking operations.

3. For auger boring, if the soil at the face of the machine is not stable and subject to flowing or fast raveling conditions, the Contractor shall adjust their means and methods to maintain a soil plug with the casing and mitigate overexcavation during auger boring.
- E. Maintain a log of soil excavated versus face advance during the tunneling or jacking operation.
1. The log shall be sufficiently accurate and updated to quickly alert the operator of the face controlling equipment of over excavation and creation of voids.
 2. Make the log available to the Owner's Representative at all times and submit a copy at the end of each shift.
 3. If at any time more soil is removed than calculated based on the forward progress, stop excavation and increase the rate of advance for the operation.
 4. When jacking pressures require it, resume excavation at the minimum necessary to maintain the minimum rate of advance necessary to prevent the casing or tunneling equipment from "freezing" in place.
 5. Determine the cause of overbreaks and correct it before continuing. Immediately report all such cases of overbreaks to the Owner's Representative.
- F. Settlement Monitoring:
1. Establish settlement monitoring points and take initial ground elevation readings before pits are excavated.
 2. Record all initial readings as a base line for comparison to subsequent readings.
 3. Take subsequent readings at the same time each day during tunneling/boring/jacking operations.
 4. Submit a copy of all readings to the Owner's Representative at the end of each day.
 5. Any settlement in excess of 1/4-inch shall be corrected by the Contractor to the satisfaction of the Owner's Representative.
- G. Settlement:
1. Execute all Work so that settlement is minimized.
 2. The completed casing shall have full bearing against earth with no voids or pockets left in any portion of the Work.

3. Surface settlement or excessive excavation volume will be conclusive evidence that voids exist.
 4. Promptly fill space between the casing and the excavated surface with grout.
 5. Provide full breasting of excavation face when operations stop for more than 2 hours or sooner as site conditions dictate.
- H. Voids: Grout to fill any voids if voids that develop outside the casing that all larger than the overcut.
- I. Obstructions: If installation is obstructed, relocate, jack, or tunnel as directed by the Owner's Representative.
- J. The CONTRACTOR shall backfill all pits excavated for casings with compacted material (select backfill, native or imported as required for adjacent trench or as otherwise specified or shown on the drawings) once construction is completed. Backfill shall be placed and compacted in accordance with Section 31 23 17.
- K. Compensation will be made for the casing installation as defined in the measurement and payment provisions located elsewhere in these specifications and regardless of the material encountered - unclassified material, rock, and transitional material.

3.3 GROUTING AROUND CASING PIPE

- A. Grouting around casing pipes shall be accomplished for all casing pipes installed by the tunneling/boring/jacking method.
- B. Immediately notify the Owner's Representative during jacking and boring operations of any situation resulting in or expected to result in the creation of voids external to the casing pipe.
- C. Upon Owner's Representative's approval, voids outside the casing pipe shall be remedied immediately or be noted and recorded for subsequent filling with cement grout.
- D. After casing pipe has been jacked into position, pressure grout to fill all voids around the casing pipe, whether or not previously noted and recorded.
- E. For parallel, side-by-side casing installations, pressure grout voids of the first installed casing prior to installing the second casing.
- F. Grout filling shall proceed as follows:
1. Start grouting at the springline hole near one end of casing.
 2. Pump grout until grout appears in the grout hole at the crown.

3. Start grouting the opposite springline hole and proceed until grout appears at the crown.
4. Grout through the crown hole until grout appears in one of the next set of holes along the casing.
5. Plug the completed holes with steel plugs.
6. Move to the next set of holes and repeat grouting sequence until grout has been applied in all the holes.
7. Finish grouting the last set of holes when grout can no longer be pumped into the crown. Grouting shall be completed in a continuous operation without stopping.
8. During grouting operations, monitor and record grout mixes, grout pressures, amount of grout used, injection rates, weather temperature and conditions, start and stop times and interval before restarting operations. Submit all data daily.
9. Monitor grout pumping pressures using pressure gauges located at the pump and at the grout manifold connection at each grout nipple being pumped. Pumping pressures shall not exceed 20 psi unless approved by the Owner's Representative.

3.4 INSTALLATION OF CARRIER PIPE

- A. Installation of ductile iron pipe shall be in accordance with AWWA C600 and manufacture's recommendations.
- B. All joints of the carrier pipe within the casing shall be restrained as shown on the Plans and as specified in Section 33 11 10, Water Utility Distribution and Transmission Piping.
- C. Application of any coatings to the interior and exterior joints shall be performed in accordance with the requirements provided for elsewhere in these Specifications.
- D. Installation of spacers on the carrier pipe and the subsequent installation of carrier pipe shall not cause damage, rupture or tear any carrier pipe or coatings. In the event of such damage, the Contractor shall repair or replace pipe or coating systems.
- E. Casing Spacers:
 1. Install casing spacers per manufacturer instructions.
 2. Provide casing spacers at carrier pipe joints, at casing ends, and along carrier pipe at no more than ten (10) foot intervals or as otherwise shown on the Plans.
 3. Provide closer spacing as may be recommended by casing spacer manufacturer.

- F. Ductile iron carrier pipe shall be pulled into casing in a controlled manner through use of a come-a-long, cable hoist and/or pulley system in order to prevent fully “homing” the spigot into the base of the connecting bell end socket, unless otherwise recommended by restraint system manufacturer.
- G. Testing and disinfection of carrier pipe shall be performed in accordance with Section 33 13 00, Testing and Disinfection of Water Utility Distribution Pipelines.

3.5 INSTALLATION OF CASING END SEALS

- A. After installation of the carrier pipe, the ends of the casing pipe shall be sealed to prevent moisture from entering the casing.
- B. Casing end seal selection shall account for required casing sand fill operation.

3.6 INSTALLATION OF SAND FILL

- A. Following review by the Owner’s Representative of the pipe grade and alignment, fill the annular space between the carrier pipe and the casing pipe with dry sand.
- B. Sand shall be installed in a manner as approved by the Owner’s Representative in submitted Work Plan.
- C. Sand shall be air blown in the annular space in a manner which assures no voids around the carrier pipe following installation.

3.7 CLEANING

- A. Backfill all pits or approach trenches excavated for Work with compacted material (select backfill, native or imported as required for adjacent trench or as otherwise specified or shown on the Plans) once construction is completed.
- B. Backfill shall be placed and compacted in accordance with Section 31 23 33, Trenching.
- C. Final surface restoration to be approved by Owner’s Representative.

END OF SECTION

SECTION 33 05 23.13 - HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Work under this specification includes all labor, equipment and materials required for installation of pipe or conduit by horizontal directional drilling (HDD). The horizontal directional drilling will typically be completed in two phases. The first phase consists of drilling a small diameter pilot hole along the designed directional path as shown on the plans. The second phase consists of enlarging the pilot hole to a diameter suitable for installation of the pipe or conduit, multiple passes maybe required to achieve the desired downhole diameter, and then pulling the pipe or conduit through the enlarged hole.

1.2 RELATED SECTIONS

- 1. Section 33 11 10.30 – HDPE Water Utility Pipe.
- 2. Supplementary Information: Geotechnical Memorandum; bore hole location and findings of subsurface materials.

1.3 HORIZONTAL DIRECTIONAL DRILLING CONTRACTOR QUALIFICATIONS

- A. Contractor shall have HDD installed five (5) pipelines or conduits of similar size and length in the past 3 years.

1.4 CONTRACTOR SUBMITTALS

- A. Layout Plan of each work area.
- B. All submittals requiring review of the OWNER'S REPRESENTATIVE shall be submitted not less than four (4) weeks prior to commencing any horizontal directional drilling activities. Submittals for each individual pipe or conduit installation shall include but are not limited to the following:
 - 1. Drilling schedule indicating the estimated number of workdays and the estimated start date for each pipe or conduit installation.
 - 2. List of equipment to be used for the drilling including directional drills, guidance systems, and drilling support equipment and general information about each piece of equipment.
 - 3. Summary description of the drilling procedures to be used on each pipe or conduit installation.

4. Composition of drilling fluid(s) to be used including Material Safety Data Sheets (MSDSs).
 5. Description of drilling fluid solids control system.
 6. Plan for minimization of excess drilling fluids and the disposal of those fluids. Provide documentation on the proposed drilling fluids disposal site that demonstrates that the site is approved by all relevant regulatory agencies and that the site owner has granted permission for the fluids disposal.
 7. Proposed plan and profile of the pilot hole alignment for each installation.
 8. Proposed pipe assembly and laydown area for each installation.
 9. An inadvertent return (IR) detection and emergency response plan suitable for approval by all regulatory agencies with authority over the directional drilling operation at the project location. The plan shall include a discussion and description of the IR potential on the project and shall include proposed conservation and restoration measures.
 10. Pulling load calculations for each installation demonstrating that the maximum specified pull loads on the pipe or conduit will not be exceeded.
- C. The CONTRACTOR shall furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section. See Section 33 11 10.30 – High Density Polyethylene Pressure Pipe for additional requirements.
- D. All expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR.

1.5 PROTECTION OF UNDERGROUND FACILITIES

The CONTRACTOR shall be responsible for locating any and all underground facilities regardless of OWNER'S REPRESENTATIVE'S previous efforts in this regard. CONTRACTOR shall be responsible for all losses and repairs to underground facilities resulting from drilling operations. The CONTRACTOR shall undertake the following steps prior to commencing drilling operations in a location which might contain underground facilities.

- A. Contact the local utility location/notification service and all other utilities and project owners not covered by this service for the construction area.
- B. Positively locate and stake all existing lines, cables, or other underground facilities including exposing any facilities which are located within 10 feet of the designed drill path.

- C. Modify drilling practices and downhole assemblies to prevent damage to existing facilities.

1.6 NOTIFICATIONS

- A. The CONTRACTOR shall give the OWNER and OWNER'S REPRESENTATIVE a minimum of two (2) weeks advance notice prior to the start of any directional drilling.
- B. All work shall be performed in the presence of the OWNER'S REPRESENTATIVE , unless the OWNER'S REPRESENTATIVE has granted prior approval to perform such work in their absence.

1.7 SAFETY

It shall be the CONTRACTOR's responsibility to see that the work is done in conformance with all applicable Federal, State, and local safety requirements.

PART 2 PRODUCTS

2.1 GENERAL

- A. All materials and equipment used in the drilling systems shall be of high quality and shall be in good condition. Horizontal directional drilling shall be performed in accordance with these specifications and in accordance with the latest edition of Horizontal Directional Drilling Good Practices Guidelines as published by the HDD Consortium and as available from the North American Society for Trenchless Technology. Horizontal directional drilling shall include all labor, equipment and consumables necessary to complete the work as shown on the plans.
- B. Pipe: The CONTRACTOR shall provide and install pipe in accordance with Section 33 11 10.30– High Density Polyethylene Pressure Pipe and Section 33 11 10.
- C. Copper clad steel tracer wire shall be direct burial #12 AWG solid (0.0808" diameter) steel core hard drawn extra high strength horizontal directional drill tracer wire, 1,150 lb. average tensile break load, 45 mil high molecular weight, high density blue complying with ASTM-D-1248, 30 volt rating, Copperhead Industries 1245G-EHS-2500, or equal.

PART 3 EXECUTION

3.1 GENERAL

- A. Unless otherwise provided, the CONTRACTOR shall furnish and install all fittings, closure pieces, jointing materials and all appurtenances as shown and as required to

provide a complete and workable installation. All fabrication and testing shall comply with the requirements listed herein.

- B. The CONTRACTOR shall carefully study the plans and specifications applicable to the work involved, notify the OWNER'S REPRESENTATIVE of any irregularities or difficulties, and become familiar with the conditions, nature of excavation, and difficulties involved with horizontal directional drilling at the site of the work.
- C. Failure on the part of the CONTRACTOR to properly appraise the factors, conditions and difficulties involved in the performance of the work will not entitle the CONTRACTOR to extra compensation of any kind, nor shall it relieve the CONTRACTOR of the obligation of executing all details of the work as specified and planned. No time extension shall be granted and no additional compensation shall be made for difficulties encountered in drilling through or around these anticipated obstructions.

3.2 WORK AREA

- A. The available work area is limited to the area designated within the construction limits as shown on the plans and/or as shown on the easements at the directional drilling entrance area and exit area.
- B. The CONTRACTOR will be responsible for constructing any required temporary work pad for directional drilling in accordance with all applicable permits and local ordinances. The CONTRACTOR shall provide culverts, rock, and geotextile if shown on the plans, complete.
- C. The CONTRACTOR shall contain the drilling fluid at all times and prevent the flow of drilling fluid out of the construction limits.
- D. If applicable to the project, the CONTRACTOR shall limit its operations within the designated temporary construction easement and permanent easement areas as shown on the drawings and/or the respective easements at the entrance and exit locations and shall adhere to all conditions and requirements of the easements granted to the OWNER.

3.3 PILOT HOLE

- A. The pilot hole shall be drilled along the path shown on the drawings and to the tolerances listed below:
 - 1. Elevation at entrance point - as designed.
 - 2. Entrance point location - within 2-foot radius of design location.
 - 3. Elevation along drill path - plus 0 feet, minus 10 feet.
 - 4. Exit point location along drill path - 5 feet beyond and 5 feet short.
 - 5. Horizontal alignment along drill path - 5 feet left or right of proposed drill path.

- B. During directional drilling, the CONTRACTOR shall survey the location of the pilot hole every 20 feet. Upon the completion of the pilot hole drilling, the CONTRACTOR shall provide a tabulation of coordinates, referenced to the drilled entry point or to another approved suitable point that can be used to create an accurate as-built plan and profile of the pilot hole. The CONTRACTOR shall utilize a directional drilling locating system to guide the location of the pilot hole and to document the final location of the pipe or conduit. The locating system shall be DigiTrak F5 Directional Drilling Location System as manufactured by Digital Control, Inc., Kent, Washington, or approved equal.

3.4 REAM AND PULL BACK

- A. Pre-reaming operations shall be conducted at the discretion of the CONTRACTOR. All provisions of this specification relating to simultaneous reaming and pulling back operations shall also pertain to pre-reaming operations.
- B. The maximum allowable pull load imposed on the HDPE pipe shall be calculated by the CONTRACTOR and submitted to the OWNER'S REPRESENTATIVE for review. The tensile stress in the pipe wall at the pull nose shall not exceed 1,100 psi for HDPE pipe. The CONTRACTOR shall have accurate working gauges which register tensile force being used to pull the pipeline back through the reamed borehole. The OWNER'S REPRESENTATIVE shall be notified immediately if pulling loads exceed 75 percent of the maximum allowable load for the pipeline. All pulling loads shall be monitored and recorded.
- C. A swivel shall be used to connect the pull section to the reaming assembly to minimize torsional stress imposed on the section.
- D. The pull section shall be supported as it proceeds during pull back so that it moves freely and the pipe is not damaged. CONTRACTOR shall provide adequate support/rollers to support the pipeline at a maximum spacing of 60 feet, or as approved by the OWNER'S REPRESENTATIVE . The rollers shall be non-abrasive and shall support the bottom and bottom quarter points the pipeline.
- E. The pull section shall be installed in the reamed hole in such a manner that the external pressures are minimized. Any damage to the pipe resulting from external pressure during installation shall be the responsibility of the CONTRACTOR.
- F. Buoyancy modification shall be used at the discretion of the CONTRACTOR. Any buoyancy modification procedure proposed for use shall be submitted to the OWNER'S REPRESENTATIVE for approval. No procedure shall be used which has not been reviewed and approved by the OWNER'S REPRESENTATIVE . Buoyancy modifications will only be allowed using potable water. The CONTRACTOR is responsible for any damage to the pull section resulting from buoyancy modifications.

- G. Prior to pipe pull back, the pipe shall be subjected to pressure testing. The entire length of pipe shall be pressure tested and visually inspected for leaks prior to pull back. Installation of the pipe will not be allowed until the pipe testing is approved by the ENGINEER. The pipe shall be tested a second time after it is in place. See Section 01650, Pipeline Testing and Disinfection for pipe pressure testing requirements.

3.5 TRACER WIRE

- A. Tracer wire is to be utilized for future locating purposes. A minimum of three separate tracer wires shall be installed with the pipe. The wire shall be secured to the pipe at maximum 10-foot intervals using 6-inch strips of 2-inch wide duct tape. The tracer wire shall be routed to the blind flanges at either end of the drilled installation to provide access to terminal ends of the wire. All locations of tracer wire intersections shall be soldered to provide electrical continuity and protected from adverse soil conditions with the use of shrink tubes or other approved waterproof connector devices. The result of the tracer wire installation shall be at least one continuous wire circuit electrical isolated from ground.
- B. Leave slack in mainline tracer wire equivalent to a 60-inch diameter loop at each end to facilitate splicing, soldering and waterproofing.
- C. Extend the tracer wire from the ends of the HDPE pipe to a plastic valve box at each end of the pipeline installation.
- D. Test for continuity and isolation from ground in the wire after all work has been completed on the test section. Perform intermediate testing after backfilling operations and prior to surface restoration work. Test continuity between access locations by use of a temporary wire connecting test points in-line with an ohmmeter. Measure resistance with an approved ohmmeter that has been properly calibrated. The continuity of a test section will be accepted if the resistance of the test section does not exceed 5 ohms for each 500 feet of location wire being tested. Measure isolation from ground with an approved 1,000 volt Megger, applied for one minute. The isolation of a test section will be accepted if the isolation resistance of the test section is at least 10 megaohms.

3.6 DRILLING FLUIDS

- A. The composition of all drilling fluids proposed for use shall be submitted to the OWNER'S REPRESENTATIVE for review and approval. No fluid will be approved or utilized that does not comply with permit requirements and/or Federal, State or local environmental and other regulations.
- B. The CONTRACTOR is responsible for obtaining, transporting and storing any water required for drilling fluids.

- C. The CONTRACTOR shall maximize recirculation of drilling fluid surface returns. The CONTRACTOR shall provide solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse. The ENGINEER will review standards for solids control and cleaning equipment performance or for treatment of excess drilling fluid and drilled spoil.
- D. Disposal of excess drilling fluids is the responsibility of the CONTRACTOR and shall be conducted in compliance with all environmental requirements. Drilling fluid disposal procedures proposed for use shall be submitted to the OWNER'S REPRESENTATIVE . No procedure may be used which has not been approved by the OWNER'S REPRESENTATIVE. Control of drilling fluids on the site is very critical. Spills of drilling fluids will not be allowed or permitted.
- E. The CONTRACTOR shall maintain full annular circulation of drilling fluids. Drilling fluid returns at locations other than the entry and exit points shall be minimized. In the event that annular circulation is lost, the CONTRACTOR shall take steps to restore circulation. If inadvertent surface returns of drilling fluids occur, they shall be immediately contained with hand placed barriers (i.e. hay bales, sandbags, silt fences, etc.) and collected using pumps as practical. If the amount of the surface return is not great enough to allow practical collection, the affected area shall be diluted with fresh water and the fluid will be allowed to dry and dissipate naturally. If the amount of the surface return exceeds that which can be contained with hand placed barriers, small collection sumps (less than five (5) cubic yards) may be used. If the amount of the surface return exceeds that which can be contained and collected using small sumps, drilling operations shall be suspended until surface return volumes can be brought under control.

3.7 INSTRUMENTATION

The CONTRACTOR shall provide and maintain instrumentation at all times which will accurately locate the pilot hole, measure drill string axial and torsional loads, and measure drilling fluid discharge rate and pressure. The OWNER'S REPRESENTATIVE will have access to these instruments and their readings at all times.

END OF SECTION

SECTION 33 11 10 - WATER UTILITY DISTRIBUTION & TRANSMISSION 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 and transmission 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. Water service connection and smaller diameter piping materials (2" and under)
 - 8. Bedding and cover materials.
 - 9. Geomembrane for gas line crossings.
- 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 24 – Flowable Fill
- G. Section 33 12 16 - Water Utility Distribution & Transmission Valves
- H. Section 33 12 19 - Fire Hydrants.
- I. 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.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on pipe materials, pipe fittings, restrained joint systems, and accessories.
- C. 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.
- D. Lining and coating data.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's handling, delivery, storage and installation requirements.
- G. Field Quality-Control Submittals:
 - 1. Pipeline hydrostatic testing plan.
 - 2. Indicate results of Contractor-furnished tests and inspections.

H. Preconstruction Photographs:

1. Submit digital files of colored photographs of Work areas and material storage areas.

1.5 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.

1.6 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 fittings and mechanical joint restraints shall be manufactured in the United States of America, except for those procured from Tyler Union, which may be provided as imported/non-domestic upon field acceptance 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.

1.7 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. Gauged Pipe:
 - a. All ductile iron pipe 24-inch diameter or greater to be cut in the field shall be gauged full length and, along the full length, shall meet the outside diameter standard dimensions and tolerances required for spigot ends along the full length of pipe to within 2 feet of the bell end.

- b. In addition to pipe supplied for anticipated cutting, a minimum of 5% of each size of piping 24-inch diameter or greater shall be provided gauged full length as described above.
 - c. Pipe shall be externally marked, in manufacturer's color, indicating gauged pipe.
- 6. Polyethylene Encasement:
 - a. Comply with AWWA C105.
 - b. Polyethylene film shall be minimum 8-mil thick virgin linear low-density polyethylene (LLDPE).
- 7. 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. 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:

- a) The maximum pipe deflection shall not exceed one half of the manufacturer's stated joint deflection allowance.

4) Manufacturers:

a) For pipe larger than 12"

- (1) "TR Flex", United States Pipe and Foundry Company.
- (2) "Flex-Ring", American Cast Iron Pipe Company.

b) For pipe 12" and smaller

- (1) "Field-Lok", United States Pipe and Foundry Company.
- (2) "Fast Grip", American Cast Iron Pipe Company.
- (3) "TR Flex", United States Pipe and Foundry Company.
- (4) "Flex-Ring", American Cast Iron Pipe Company.

c) For all pipe sizes

- (1) "MEGALUG", EBAA Iron, Inc.

- (a) 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.

- (b) Wedge-type mechanical restraining glands shall not be used to restrain the plain end of plain end ductile iron or cast iron fittings.

- (2) "Foster Adaptor", Infact Corporation

- (a) Where specified, mechanical joint (MJ) valves and fittings shall be connected using a bolt-through positive restraint mechanism manufactured of ductile iron conforming to ASTM A536, 65-45-12.

- (b) The positive restraint device shall connect the valves and/or fittings at a linear distance not to exceed three (3) inches and without attachment to pipe.

- (c) The device shall come complete with all accessories, including standard styrene butadiene rubber (SBR) MJ gaskets conforming to the latest revision of AWWA C111/ASTM F-477 and

weathering steel (Corten) bolts conforming to AWWA C111/A21.11 and ASTM A242.

- (d) Nuts for 3 through 12-inch sizes shall be SAE Grade 5 steel with black oxide coating. Nuts for 14-inch and larger adaptors shall be heavy hex Corten steel conforming to ASTM A242.
- (e) MJ positive restraining device shall be supplied with NSF 61, 7-mil. fusion bonded epoxy conforming to AWWA C116/A21.16-09 as well as the coating, surface preparation and application requirements of ANSI/AWWA C550.
- (f) The device shall be used with standard mechanical joint fittings (AWWA C110 or C153) and valves, and shall be Infact Corporation FOSTER ADAPTOR or equal.

e. Flanged Joints:

- 1) Flat faced, complying with AWWA C111 and C115, unless otherwise specified.
- 2) Bolt hole drilling according to ASME/ANSI B16.1, Class 125, or ASME/ANSI B16.1, Class 250, where specified. 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) Pressure rating of flange joints shall not exceed the rating of the pipe or fitting of which they are a part and the maximum pressure rating of the joint shall be 250 psi.
- 5) Flange joint connections shall not be exposed to test pressures greater than 1.5 times their rated working pressure.
- 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 wax tape as specified herein..

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) See Specification Section 26 42 01 – *Corrosion Monitoring System for Ductile Iron Pipe* for requirements for insulated flange joints.

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.
3. Wax Tape Coating System (Field Coating): Petrolatum wax tape coating system:
 - a. General: Apply a wax tape coating system generally per AWWA C217 and consists of three parts: surface primer, wax-tape, and outer covering. All three parts shall be the product of the same manufacturer.
 - b. The primer shall be a blend of petrolatum, plasticizer, and corrosion inhibitors having a paste like consistency. It shall have a pour point of 100-degrees F to 110-degrees F and a flash point of 350-degrees. Use Trenton Wax-Tape Primer or approved equal.
 - c. The wax-tape shall consist of a synthetic-fiber felt, saturated with a blend of high melt microcrystalline wax, solvents, and corrosion inhibitors, forming a tape coating that is easily formable over irregular surfaces and which firms up after application. The tape shall have a saturant pour point between 125-degrees F and 130-degrees F and a dielectric strength equal to a minimum of 100-volts per mil. Tape thickness shall be 50-mils to 90-mils in 6-inch wide rolls. Use Trenton No. 1 wax-tape or approved equal.
 - d. The outer covering shall consist of two layers of a plastic wrapper at total of one 150 gauge or three 50 gauge wound together as a single sheet.. The plastic wrapper material shall consist of clear polyvinylidene chloride, high cling membranes wound together as a single sheet. Use Trenton Poly-Ply or approved equal.
- 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.
- D. Higher-strength bolts with higher torque values as specified above for operation pressures greater than 150 psi shall not be used for assembly of flange joints including gray-iron flanges.

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 12-inch diameter:
 - 1) Romac Industries, Inc. – Style 501 or equal.

- b. For 14-inch diameter and larger:
 - 1) Romac Industries, Inc. – 400 Series or equal.
- C. Insulating Flexible Couplings:
 - 1. See Specification Section 26 42 01 – *Corrosion Monitoring System for Ductile Iron Pipe* for requirements for insulated flexible couplings.
- 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 inch.
 - 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 WATER SERVICE CONNECTION AND SMALLER DIAMETER PIPING MATERIALS (2" AND UNDER)

A. Service Saddles

- 1. General: Saddles used for 1-inch service lines shall have an AWWA tapered thread outlet. Saddles used for 2-inch service lines and ARV taps shall have a female iron pipe thread
- 2. Service saddles shall be double strap, cast iron Style 202NS as manufactured by Romac Industries. Straps to be stainless steel and cast-iron casting to be coated with fusion bonded nylon. Gasket shall be NBR compounded for water service and

bonded integral to sleeve. Bolts and nuts shall be 5/8-inch Type 304 stainless steel with nuts coated to prevent galling. compounded for water service and bonded integral to sleeve. Bolts and nuts shall be 5/8-inch Type 304 stainless steel with nuts coated to prevent galling.

B. Polyethylene Tubing Service and ARV Branch Pipe

1. Polyethylene tubing service and ARV branch pipe shall meet the requirements of AWWA C901. Tubing shall be high molecular mass with a 200 psi rating. Tubing used 5/8x3/4 and 1-inch meter assemblies shall be 1-Inch Dia. SDR 7 (PE 3408) Iron Pipe Size. Tubing used for 1-1/2-Inch and 2-Inch meter assemblies shall be 2-inch Dia. SDR 7 (PE 3408) Iron Pipe Size.

C. Brass and Bronze Piping

1. Brass Pipe shall conform to the standard dimensions, weights, and tolerances for "regular" weight pipe in accordance with ASTM B43. Material composition shall be copper alloy UNS No. C23000. Pipe shall be furnished in the annealed condition to Standard No. "O 61" in accordance with ASTM B601. Testing and certification of results shall be prepared by the manufacturer in accordance with the ASTM Specification for each of the categories being bid. In addition, mill test reports for the brass pipe in accordance with ASTM B43 shall be provided.
2. Brass Fittings
 - a. Brass and bronze service fittings shall conform to the latest version of AWWA C800.
 - b. Service fitting materials in contact with potable water shall be made of copper alloys in accordance with the chemical and mechanical requirements of ASTM B584, meeting the "lead free" requirements as specified above.
 - c. All castings shall not have injurious blowholes, porosity, shrinkage defects, cracks, or other injurious defects. Castings shall not be plugged, welded, burned in, or impregnated. All threads shall mesh snugly, be clean cut, and be of uniform pitch. All valves shall be carefully cored and machined to insure evenly balanced walls. The keys shall be properly machined and ground and shall be covered with a non-corrosive non-toxic grease. Mechanical surfaces shall have a 100% machine finish with no gaps or low spots due to insufficient parent material.
 - d. All fittings shall either be stamped or embossed with the manufacturer's name. Another marking identifying the item as complying with NSF 61 per the requirements of NSF 372 for "lead free" as described under 2.1.A above, e.g.,

'NL or G for Annex G', shall be cast or permanently stamped on the service fitting.

3. Brass and Bronze Pipe Nipples

- a. Brass pipe nipples shall be in conformance with ASTM B687. Pipe nipples shall meet the composition and mechanical properties for pipe. Threads for pipe nipples will conform to Sections 6 and 11 of AWWA C800, and ASME/ANSI Standard B1.1 as noted in Category B. Standard length and size of nipples shall conform to Section 7 and Table 2 of ASTM B687 for standard close nipples. All other provisions of ASTM B687 "Brass, Copper and Chromium-Plated Pipe Nipples" shall apply to the materials furnished

4. Angle Meter Valves

- a. Angle meter valves shall be of the ball type and shall be made of bronze alloy. Valve shall have pack joint fittings for service pipe and a meter swivel nut. Valves shall be quarter turn and shall have a lock wing. Angle meter valves shall be No Lead Brass as manufactured by Ford Meter Box Company, A.Y. McDonald Company, or approved equal.

5. Corporation Stops

- a. Corporation stops shall be of the ball type and shall be made of bronze alloy. Valves shall have pack joint fittings for service pipe. Corporation stops for direct tapping shall have AWWA tapered thread inlet and outlet connections compatible with polyethylene tubing.
- b. Corporation stops used with 1-inch outlet saddles shall have either AWWA tapered thread or male iron pipe thread inlets and outlet connections compatible with polyethylene tubing. Thread patterns for the saddle outlet and corporation stop inlet shall be the same.
- c. Corporation stops used with 1-1/2 to 2-inch outlet saddles shall have male iron pipe thread inlets and outlet connections compatible with connecting service or ARV branch pipes.
- d. Corporation stops shall be No Lead Brass as manufactured by Ford Meter Box Company, A.Y. McDonald Company, or approved equal.

6. Curb stops

- a. Curb stops shall be of the ball type and shall be made of bronze alloy. Stops shall have pack joint fittings for service pipe. Valves shall be quarter turn. Curb stops shall be Lead Free as manufactured by Ford Meter Box Company, A.Y. McDonald Company, or approved equal.

7. All buried brass and bronze piping shall be spirally wrapped with polyvinyl chloride pressure sensitive tape. See Section 26 42 01 – Corrosion Monitoring System for DI Pipe for requirements.

D. Copper Pipe

1. Copper pipe unless specified elsewhere shall be Type “L”, hard drawn, conforming to ASTM B88. Copper pipe under floor slabs, underground or cast in concrete shall be Type “K”.

E. Galvanized Steel Pipe and Fittings

1. Galvanized steel pipe shall be seamless, or electric resistance welded, ASTM A120, Schedule 40. Joints for galvanized steel pipe shall be threaded. Fittings shall be threaded, 150 lb. malleable iron, galvanized, ASTM A197 or ASTM A47, dimensions conforming to ANSI B16.3; Unions, 300 lb. malleable iron, galvanized with dimensions conforming to ANSI B16.3, brass to iron seat. Thread lubricant shall be Teflon tape or joint compound that is insoluble in water.
2. All buried galvanized pipes shall be spirally wrapped with polyvinyl chloride pressure sensitive tape. See Section 26 42 01 – Corrosion Monitoring System for DI Pipe for requirements.

2.9 UNDERGROUND PIPE MARKERS

- A. As specified in Section 31 23 17, Trenching.

2.10 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. As specified in Section 03 11 00 - Concrete Work.
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 11 00 – Concrete Work.

2.11 BEDDING AND COVER MATERIALS

A. Bedding and Cover:

1. Pipe Bedding: Coarse Aggregate Material Type A1, 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 A1, 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 or S2, as specified in Section 31 05 13, Soils for Earthwork.

2.12 GEOMEMBRANE FOR GAS LINE CROSSINGS

- A. Furnish 40 mil reinforced geomembrane with 300V/mil dielectric strength and minimum 150# puncture resistance and 150# tensile strength. Geomembrane shall be XR-5 as manufactured by Seaman Corporation, or approved equal.

2.13 ACCESSORIES

- A. Concrete for Thrust Restraints: As specified in Section 03 11 00 – Concrete Work.
- B. Manhole and Cover: As specified in Section 33 05 13 - Manholes and Structures.
- C. 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. Deflection:
 - a. The maximum pipe deflection shall not exceed one-half of the manufacturer's stated joint deflection allowance.
 - b. Set a laser, string line or other approved alignment guide along the centerline of previously installed pipe to the point where pipe joint deflection is required. The approved alignment guide shall extend to the end of the proposed subsequent pipe length. A measurement will be taken from the alignment guide to the centerline of the subsequent pipe length to determine the amount of pipe joint deflection proposed. Measured deflection shall not exceed the specified allowable deflection for the purposes of aligning the pipe.
10. 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.
11. 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.

12. 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.

13. Prevent foreign material from entering pipe during placement.

14. Install pipe to allow for expansion and contraction without stressing pipe or joints.

15. Close pipe openings with watertight plugs during Work stoppages.

16. All pipe ends which are to be permanently closed shall be plugged or capped and restrained against internal pressure.

17. Install access fittings to permit disinfection of water system performed under Section 33 13 00 – Testing and Disinfecting of Water Utility Piping.

18. Cover:

- a. Establish elevations of buried transmission main piping with not less than 60 inches of cover and as shown on the Plans.
- b. Measure depth of cover from final surface grade to top of pipe barrel.

19. Pipe Markers:

- a. Install as specified in Section 31 23 17, Trenching.

C. Tapping Sleeves and Valves:

- 1. As indicated on Drawings and according to manufacturer instructions.

D. Wax tape Coating for DI Fittings, Valves and Appurtenances:

- 1. Coat all buried DI fittings and valves, mechanical joints and restraints, and pipe flanges with wax tape coating system in accordance with AWWA C217 and in accordance with manufacturer's recommendations. Extend the wax tape coating system over the adjacent ductile iron piping past the fitting, restraint, flange, etc. by a minimum 6-inches.

2. The surfaces to receive the wax tape coating shall be clean and free of all dirt, grease, and other foreign material. Apply primer as recommended by tape manufacturer or cut strips of wax tape and apply them around all bolts, nuts, mechanical joint restraints, and other irregular shapes so that there are no voids or spaces under the tape. Apply a sufficient amount of tape to completely encapsulate all exposed steel surfaces. The minimum wax tape thickness shall be 70 mils over smooth surfaces and 140 mils over sharp and irregular surfaces, or of a thickness required to fill all voids. Apply two layers of polyvinylidene chloride, high cling membrane sheet over the wax tape coating by tightly wrapping it around the pipe such that it adheres and conforms to the wax tape. Secure the plastic wrap to the pipe with adhesive tape.

E. Polyethylene Encasement

1. Encase all buried DI piping, pipe fittings, valves and appurtenances in polyethylene to prevent contact with surrounding backfill material per the requirements of AWWA C105.
2. Encase DI fittings, valves, and appurtenances in polyethylene after wax tape coating system has been applied as specified herein.

F. 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 details 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.

G. Backfilling:

1. Backfill of piping systems shall be as specified in Section 31 23 17, Trenching.

H. Testing and Disinfection of Potable Water Piping System:

1. In accordance with AWWA C600 and 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 Oregon State Department of Environmental Quality (DEQ) 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 a dechlorination under a plan meeting DEQ's requirements.

3.4 FIELD QUALITY CONTROL

- A. Compaction Testing: See Section 31 23 17, Trenching for Compaction Testing requirements for piping trenches.

END OF SECTION

SECTION 33 11 10.30 - HDPE WATER UTILITY 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, and ANSI/AWWA C901, AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, 3/4"-inch through 3-inch, for water service.

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 may also be PE 4710 in accordance with the pending revisions to ANSI/AWWA C906-07. All HDPE pipe and fittings shall be of the dimension ratio (DR) as shown on the plans.

The pipe shall be color striped as follows: Blue (WATER).

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.

D. Tracer Wire

Copper clad steel tracer wire shall be direct burial #12 AWG solid (0.0808-inch diameter), steel core hard drawn extra high strength horizontal directional drill tracer wire, 1,150-pound average tensile break load, 45-mil high molecular weight, high density blue polyethylene jacket complying with ASTM-D-1248, 30-volt rating, Copperhead Industries 1245G-EHS-2500 or equal.

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 degrees Fahrenheit (F), alignment, and 75 pounds per square inch (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 TRACER WIRE

For an installation using horizontal directional drilling (HDD) method, extend the tracer wire from the ends of the HDPE pipe to a plastic valve box at each end of the pipeline installation. For other installations, extend the tracer wire to plastic valve boxes along the pipeline route at approximate 1,000-foot intervals or as shown on the Drawings or as otherwise directed by the ENGINEER. Provide 2 feet of slack at the ends of the wire. Demonstrate that the copper conductor is electrically continuous after installation of the pipeline.

3.6 HYDROSTATIC PRESSURE TESTING

Test all sections of HDPE pipe per the requirements of Section 33 13 00 Testing and Disinfecting of Water Utility Piping.

3.7 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 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 filling with CLSM and abandonment in place of existing buried piping.
- B. A portion of the existing buried piping to be removed and filled with CLSM and abandoned in place along the NE Stephens ROW is coated with coal tar epoxy coating wrap system which contains asbestos. This work shall include obtaining permits, mobilization of equipment, insurance coverage, bonding, preparation of job site, preparing site staging area, security measures, and clean-up necessary for satisfactory completion of work.
- C. Section includes:
 - 1. Pipe removal.
 - 2. In-place abandonment of pipe with and without filling with CLSM.
 - 3. Asbestos abatement requirements for buried pipe removal and cut-ins

1.2 RELATED SECTIONS

- A. Section 31 23 16 - Excavation
- B. Section 31 23 17 - Trenching
- C. Section 31 23 19 – Dewatering
- D. 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. Provide an asbestos management plan containing the following information, and as required in Subsection 3.4.
 - 1. Submit qualifications of company(s) that demonstrate an accredited asbestos surveyor will complete an asbestos survey of the affected area of the site including a bulk sample of the waterproofing material and concrete substrate.
 - 2. Submit qualifications of company(s) that demonstrate a licensed asbestos abatement Contractor will properly handle, remove, and dispose of asbestos material to be removed as part of this project.
 - 3. Submit documentation certifying the proper handling and disposal of the asbestos material to be removed as part of this project.
- D. Non-Shrink Grout
 - 1. Certified Test Results: Verifying the compressive strength, shrinkage, and expansion requirements specified herein.
 - 2. 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.
- E. 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 at no cost to the OWNER. Permits may include, but are not limited to, a DEQ ASN1 notification, a DEQ ASN6 notification, and an application to DEQ for any variances, if applicable, that includes, but is not limited to, all required paperwork, work practices and proposed procedures clearly documented for approval by DEQ.
- 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 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, non-corrosive, non-chloride, 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 5,000 pounds per square inch (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 5,000 psi and shall meet the requirements of CRD C621.

2.3 CONTROLLED LOW STRENGTH MATERIAL

- A. As specified in Section 31 23 24, Flowable Fill.

PART 3 EXECUTION

3.1 PIPE REMOVAL (WITHOUT ASBESTOS; SEE SUBSECTION 3.4 FOR WITH ASBESTOS)

- 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 33, 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 Drawings, 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 HANDLING, CUT-IN, REMOVAL AND DISPOSAL OF ABANDONED 20-INCH STEEL PIPING WITH COAL TAR COATING CONTAINING ASBESTOS ALONG NE STEPHENS

- A. When piping along NE Stephens with coal tar coating containing asbestos is to be exposed and cut-in or removed and disposed of the CONTRACTOR shall comply with OAR 340-248, ORS 468A.700 to 468A.760, and all Oregon DEQ rules and regulations. The pipe with coating containing asbestos material shall be disposed of together as hazardous waste if required to comply with all applicable Oregon DEQ requirements as enforced by the OAR.

All pipe coating material that contains asbestos shall be handled in such a manner to ensure removal from the reservoir site without causing the release of free asbestos fibers.

Contractor shall remove and dispose of all asbestos containing materials encountered, except that may remain buried, undisturbed and abandoned in-place per the project specifications. Contractor is responsible for proper identification,

handling, and disposal of asbestos materials. Contractor shall provide properly trained and certified workers and shall be prepared to deal with both friable and non-friable forms of asbestos. Permit and permit fees related to this work shall be the Contractor's responsibility. Contractor is solely responsible for pursuing work in a way that is consistent with all state, local, and federal rules, regulations and guidelines. An asbestos management plan shall be provided to engineer a minimum of four weeks prior to the work being performed and shall address the following:

- Personnel training and experience
- Subcontracted specialists including contact information
- Anticipated work scope and contingency measures
- Worker Safety and OSHA compliance
- Plan for DEQ Permitting and Compliance
- Plan for removal and disposal of friable material
- Plan for remove and disposal of non-friable material

The Contractor shall remove all asbestos contaminated material from the project site for disposal at a landfill licensed to handle asbestos waste.

3.5 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 16 - WATER UTILITY DISTRIBUTION & TRANSMISSION VALVES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes valves and valve boxes for installation with buried water distribution and transmission 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
 - 2. Section 33 11 10 - Water Utility Distribution & Transmission Piping
 - 3. Section 33 13 00 - Testing and Disinfecting of Water Utility Distribution

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.
- B. Coordinate Work of this Section with the City of Roseburg Public Works Department standards and utilities within construction area.

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 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.

1.7 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 & Transmission Piping.
- C. Gaskets:
 - 1. As required for the end connection types specified in Section 33 11 10, Water Utility Distribution & Transmission 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 & Transmission Piping.
- D. Gaskets:
 - 1. As required for the end connection types specified in Section 33 11 10, Water Utility Distribution & Transmission 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, or as shown on the plans.

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 30 00, Cast-in-Place Concrete.

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 & Transmission 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 Distribution.

B. Field Testing of Valves:

1. All valves 24-inch diameter or larger, and all in-line transmission main valves, shall be pressure and leakage tested at the Site and shall pass the field testing prior to installation.

2. Valves shall be tested at 1.5 times normal operating pressure, 150 psi minimum.
3. No valve shall be accepted for installation that fails to pass the field pressure test. Any valves failing field pressure tests shall be replaced by the Contractor at no additional cost to the Owner.
4. Engineer shall witness field testing.

END OF SECTION

SECTION 33 12 19 - FIRE HYDRANTS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section addresses dry-barrel fire hydrants used in water supply service.
- B. Section includes:
 - 1. Fire hydrants used in water main installations.

1.2 RELATED SECTIONS:

- A. Section 03 11 00 – Concrete Work
- B. Section 31 05 16 - Aggregates for Earthwork
- C. Section 31 23 17 - Trenching
- D. Section 33 13 00 – Testing and Disinfecting of Water Utility Piping

1.3 REFERENCE STANDARDS

- A. American Water Works Association (AWWA):
 - 1. AWWA C502 - Dry-Barrel Fire Hydrants
 - 2. AWWA C550 - Protective Interior Coatings for Valves and Hydrants
 - 3. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 291 - Recommended Practice for Fire Flow Testing and Marking of Hydrants

1.4 COORDINATION

- A. All hydrants supplied for the Project shall be of like kind from a single manufacturer.

1.5 SUBMITTALS

- A. Section 01 33 00, Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's latest published literature, including illustrations, installation and maintenance instructions, and parts lists.
- C. Shop Drawings: Submit description of proposed installation.
- 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.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of fire hydrants and service valves.
- B. Operation and Maintenance Data: Submit data for hydrants.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Prepare hydrants and accessories for shipment according to AWWA standards.
- B. Seal hydrant 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 potential damage.
 - 2. Do not store materials directly on ground.
- E. Handle materials in a way that prevents damage to interior and exterior surfaces.

PART 2 PRODUCTS

2.1 FIRE HYDRANTS

- A. Manufacturers:
 - 1. American Flow Control, Water Pacer WB-67-250
 - 2. American AVK, Series 2780 Nostalgic
 - 3. East Jordan (EJ), Watermaster 5CD250 2-Nozzle

All hydrants to be integrated with Storz Fitting, or the adaptor

- B. Dry-Barrel Breakaway Type:
 - 1. Comply with AWWA C502.
 - 2. Body: Cast iron.
 - 3. Valve: Compression type.
 - 4. Burial Depth: As indicated on Drawings.
 - 5. Inlet Connection Size: 6 inches (150 millimeters).

6. Valve Opening: 5-1/4 inches (133 millimeters) in diameter.
7. End Connections: Mechanical joint or bell end.
8. Bolts and Nuts: Galvanized steel.
9. Interior Coating: Comply with AWWA C550.
10. Direction of Opening: Counterclockwise unless otherwise indicated.

C. Hose Connections:

1. One 4-1/2-inch diameter pumper, two 2-1/2-inch diameter hose nozzles.
2. Obtain thread type and size from local fire department.
3. Attach nozzle caps by separate chains.

D. Finishes:

1. Primer and two coats of enamel.
2. Color: R-1317, Safety Yellow.

2.2 NSF INTERNATIONAL (NSF) REQUIREMENTS

- A. All fire hydrants must be NSF/ANSI Standard 61 certified 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.

2.3 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type as specified in Section 03 1 00, Concrete Work.
- B. Aggregate: Aggregate for hydrant drainage as specified in Section 31 05 16, Aggregates for Earthwork.

2.4 OUT OF SERVICE COVERS/OUT OF SERVICE RINGS

- A. Provide orange plastic bag with reflective tape, or red plastic hydrant out of service rings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify location and size of hydrants from Drawings. Final location of hydrants to be determined by Engineer in the field.
- B. Obtain clarification and directions from Engineer prior to execution of Work.

- C. If installing a hydrant on an existing water system, verify invert elevation of existing piping is as indicated on Drawings prior to excavation and installation of fire hydrant.

3.2 PREPARATION

- A. Conduct operations not to 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. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
 - 1. Notify Owner and Engineer not less than 48 hours in advance of proposed utility interruption.
 - 2. Do not proceed without written permission from Engineer.
 - 3. Only District staff shall operate valves in existing system.

3.3 INSTALLATION

- A. Perform trench excavation, backfilling, and compaction as specified in Section 31 23 17, Trenching.
- B. Install pier support block and drainage gravel for fire hydrants; do not block drain hole.
 - 1. Place drainage gravel around the pier block and bottom of hydrant to 6 inches above the hydrant drain opening.
 - 2. Place textile fabric to cover drain rock prior to placement of backfill.
 - 3. Setting shall allow the hydrant barrel to drain into drainage gravel at base of hydrant.
- C. Set fire hydrants plumb with pumper nozzle facing roadway.
- D. Set fire hydrants with centerline of pumper nozzle 18 inches (450 millimeters) above finished grade, and with safety flange not more than 6 inches (150 millimeters) nor less than 2 inches (50 millimeters) above grade. Install hydrant extensions where required and as approved.
- E. Paint hydrants according to color scheme of local authorities having jurisdiction. Touch up paint after hydrant installation and testing.

- F. After hydrostatic testing, flush hydrants and check for proper drainage.
- G. Disinfection of Water Piping System:
 - 1. Flush and disinfect system as specified in Section 33 13 00, Testing and Disinfecting of Water Utility Piping.

3.4 FIELD QUALITY CONTROL

- A. Pressure test water distribution system according to AWWA C600 and Section 33 13 00, Testing and Disinfection of Water Utility Piping.

3.5 CONCRETE HYDRANT PADS

- A. When hydrant is place within sidewalks, form and pour-in-place 36-inch by 36-inch by 6-inch, 4,000 pounds per square inch (psi) concrete pad around the hydrant after the hydrant has been installed and set to grade.
- B. Center hydrant pad on the hydrant. Set hydrant pad so top of pad is flush with surrounding surface, or as directed by the Engineer.
- C. Hydrant pads may be adjusted to reach the back of curb if the hydrant pad is no less than 1-foot in any one direction.

3.6 OUT-OF-SERVICE HYDRANTS

- A. To indicate that the fire hydrant is NOT operational, secure reflective tape, an orange plastic bag over the entire hydrant assembly or an approved out-of-service cover.
- B. An out-of-service ring may also be used in addition to the bag or cover in case of removal of the cover.
- C. Maintain the plastic bag up until the waterline is accepted by the Owner.

END OF SECTION

SECTION 33 13 00 - TESTING & DISINFECTION 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. This section also includes pressure testing of HDD installed HDPE cased crossing of railroad right-of-way for water service replacement on Hooker Road.
- B. Section Includes:
 - 1. Pressure testing and disinfection of potable water distribution and transmission piping systems and appurtenances.
 - 2. Pressure testing of HDPE casing
 - 3. Testing and reporting of results.
- C. Related Requirements:
 - 1. Section 33 05 23.13 Horizontal Directional Drilling
 - 2. Section 33 11 10 - Water Utility Distribution & Transmission Piping
 - 3. Section 33 11 10 .30 – HDPE Water Utility Piping
 - 4. Section 33 12 16 - Water Utility Distribution & Transmission Valves
 - 5. Section 33 12 19 - Fire Hydrants.

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 C651 - Disinfecting Water Mains.
 - 5. AWWA C655 - Field Dechlorination.
 - 6. AWWA M55 - PE Pipe, Design and Installation

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. Hydrostatic testing of the HDPE portion(s) of the water pipeline shall be conducted separately from ductile iron pipe portions. Contactor shall make provisions for isolating all segments of different materials required to complete testing of the entire pipeline. Any additional equipment, fittings, water, other materials and labor required to isolate the segments and to test the segments separately shall be considered incidental to this task.
- C. 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.
- D. 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.
- E. 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.

F. Testing of DI Mains:

1. Ductile Iron: In accordance with AWWA C600.
2. 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.
3. 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.

4. 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.

5. 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.

G. Testing of HDPE Casing:

1. HDPE: In accordance with AWWA M55, and as specified herein.

- a. All HDPE pipe shall be hydrostatically tested twice. The first test shall be conducted above-grade after the pipe is butt fused and ready for installation. The second test shall be conducted after the pipe is in place in the trench or, in the case of installation by the horizontal directional drilling method, the pipe

has been pulled into place. Prior to conducting the second test, the pipe shall be flushed.

- b. Before commencing each test, the pipeline shall be filled with water to the specified test pressure and allowed to stand without makeup pressure until the pressure reaches equilibrium. Equilibrium will usually occur within 2 to 4 hours. After equilibrium has been reached, the test section shall be returned to the specified test pressure and the test period can begin.
- c. All HDPE piping shall be tested under a hydrostatic test pressure not less than 150 psi (+/- 5 psi) at the highest point along the test section or as shown on the plans. Testing shall be performed by applying the specified test pressure by pumping. Once the test pressure has been attained, the pump shall be valved off. The test will be conducted for one two-hour period. The required makeup water volume shall not exceed the allowance for expansion during a two-hour test in the following table.

Nominal Pipe Size (inches)	Allowance for Expansion (US gallons/100ft. of pipe)
3	0.20

- d. During the above-grade test, the pipe shall be visually inspected for leaks. All leaks shall be repaired before installing the pipe in the trench or pulling the pipeline into the borehole. Leaks at fusion joints shall be repaired by cutting out the leaking fusion joint, refusing the joint and conducting a new above grade test.
- e. The second pressure test shall be made after the first pressure test has been successfully completed and approved by Engineer and the HDPE pipeline is installed. For HDPE pipe installed by the horizontal directional drilling method, the test section shall be the full length of pipeline that is pulled into place. After the equilibrium period, the pressure test shall proceed for a period of two hours. Makeup water shall not exceed that specified above. If the test fails, the installed pipe section shall be removed and replaced with new HDPE pipe at Contractor's expense.
- f. Contractor shall schedule pressure testing such that pressure changes due to thermal expansion or contraction of the pipe during the test period are minimized.
- g. If the testing reveals any defects, any leakage, or any failure, Contractor shall furnish all labor, equipment and materials required to locate and make necessary repairs. The testing of the line and repairing of defects, excessive leakage, and failures shall be repeated until a test satisfactory to Engineer has

been achieved. All costs for locating, repairing, and retesting shall be borne by Contractor.

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 Oregon State Department of Environmental Quality (DEQ).

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 Oregon Health Authority 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 41 10 - STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes pipe materials and accessories normally used with gravity storm drainage sewers.
- B. Section includes:
 - 1. Storm drainage piping
 - 2. Piping accessories
 - 3. Connection to existing manholes
 - 4. Catch basins and area drains
 - 5. Cleanouts
 - 6. Bedding and cover materials

1.2 RELATED SECTIONS

- A. Section 03 11 00 – Concrete Work
- B. Section 03 60 00 - Grouting
- C. Section 31 05 13 - Soils for Earthwork
- D. Section 31 05 16 - Aggregates for Earthwork
- E. Section 31 23 16 - Excavation
- F. Section 31 23 17 - Trenching
- G. Section 31 23 23 - Fill
- H. Section 33 05 13 - Manholes

1.3 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 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 Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International (ASTM):
 - 1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
 - 2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
5. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
6. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
7. ASTM C1479 - Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.
8. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
9. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
10. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
11. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
12. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
13. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
14. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
15. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
16. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
17. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

18. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 19. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- C. American Water Works Association (AWWA):
1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
 3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 4. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
 5. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
 6. 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.

1.4 COORDINATION

- A. Notify affected utility companies at least 72 hours prior to construction.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 00, Submittal Procedures.
- B. Product Data: Submit manufacturer catalog cuts and other information indicating proposed materials, accessories, details, and construction information.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. The certificate shall be signed by an authorized agent of the manufacturer.
- D. Test and Evaluation Reports: Submit reports indicating field tests made and results obtained.
- E. Manufacturer Instructions:
1. Indicate special procedures required to install specified products.
 2. Submit detailed description of procedures for connecting new storm sewer to existing storm sewer line.

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

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record invert elevations and actual locations of pipe runs, connections, manholes, and cleanouts.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Storage:
 - 1. Store materials according to manufacturer instructions.
- C. Protection:
 - 1. Protect materials from moisture, dust, and direct sunlight by storing in clean, dry location remote from construction operations areas.
 - 2. Block individual and stockpiled pipe lengths to prevent moving.
 - 3. Provide additional protection according to manufacturer instructions.

1.8 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

- A. Polyvinyl Chloride (PVC) Pipe:
 - 1. Material:
 - a. Manufactured from rigid polyvinyl chloride compounds conforming to ASTM D1784, Class 12454-B.

- b. At locations indicated in the Drawings, pipe shall conform to AWWA C900.
- 2. Pipe and fittings 4 inches to 15 inches in diameter, non-pressurized:
 - a. Comply with ASTM D3034, SDR 35.
- 3. Pipe and fittings 18 inches and larger in diameter, non-pressurized:
 - a. Comply with ASTM F679, PS46.
 - b. Pipe shall have a minimum stiffness of 46 pounds per square inch (psi).
- 4. AWWA C900 Pipe:
 - a. At locations shown in the Drawings.
 - b. Four inches to 12 inches in diameter.
 - c. DR 25.
 - d. Pipe shall have minimum stiffness of 149 psi.
- 5. End Connections: Bell and spigot style, with rubber-ring-sealed gasket joint.
- 6. Joints:
 - a. Integral bell push-on type: Comply with ASTM D3212.
 - b. For use with AWWA C900 pipe: Integral bell push-on type comply with ASTM D3139.
- 7. Gaskets:
 - a. Factory installed.
 - b. Elastomeric gaskets: Comply with ASTM F477.
- B. Ductile Iron Pipe:
 - 1. Comply with AWWA C151.
 - 2. Minimum Special Thickness Class: 52.
 - 3. End Connections: Bell and spigot or plain, as shown in the Drawings.
 - 4. Outside Coating:
 - a. Type: Asphaltic coating, minimum 1-mil uniform thickness.
 - b. Comply with AWWA C151.

- 5. Lining:
 - a. Cement mortar lined.
 - b. Comply with AWWA C104.
- 6. Fittings:
 - a. Material: Ductile iron.
 - b. Comply with AWWA C153 or AWWA C110.
 - c. Lining: Cement-mortar lined according to AWWA C104.
- 7. Coating:
 - a. Asphaltic exterior coating in accordance with AWWA Standard C151.
- 8. Joints:
 - a. Rubber gasket joint devices.
 - b. Comply with AWWA C111.
- C. High Density Polyethylene (HDPE) Pipe:
 - 1. Double wall, ribbed pipe with smooth interior.
 - 2. Solid pipe, perforated pipe, and fittings shall meet the requirements of ASTM F-405 and F-667
 - 3. Pipe 3 inches to 10 inches in diameter: Comply with AASHTO M-252.
 - 4. Pipe 12 inches to 36 inches in diameter: Comply with AASHTO M-294.
 - 5. Joints: Integral bell push-on type.
 - 6. Manufacturers:
 - a. ADS, N-12 with Pro Link joints, or approved equal.
- D. Acrylonitrile-Butadiene-Styrene (ABS) Pipe:
 - 1. Single walled. Comply with ASTM D2680, SDR 23.5.
 - 2. Perforated.
 - a. Three-eighths-inch diameter holes, 3 inches on center.
 - 3. Inside Nominal Diameter: 4 inches.
 - a. Minimum Wall Thickness: 0.140 inches.

- b. One row of perforations on each side of pipe, approximately 45 degrees above bottom centerline of pipe.
- 4. Inside Nominal Diameter: 6 inches.
 - a. Minimum Wall Thickness: 0.200 inches.
 - b. Two rows of perforations on each side of pipe, approximately 45 degrees above bottom centerline of pipe.
- 5. Ends:
 - a. Style: Bell and spigot.
 - b. Type: Solvent sealed.
- 6. Fittings: ABS.
- 7. Joints:
 - a. Type: Solvent weld.
 - b. Comply with ASTM D2235.
- E. Reinforced Concrete Pipe:
 - 1. Comply with ASTM C76, Class V, with Wall Type C.
 - 2. Reinforcement: Mesh.
 - 3. End Connections: Bell and spigot.
 - 4. Fittings: Reinforced concrete.
 - 5. Joints:
 - a. Rubber compression gasket.
 - b. Comply with ASTM C443.

2.2 FLEXIBLE COUPLINGS

- A. Description:
 - 1. Resilient chemical-resistant elastomeric polyvinyl chloride (PVC) coupling.
 - 2. Attachment: Two Series 300 stainless-steel clamps, screws, and housings.

2.3 FLEXIBLE PIPE BOOT FOR MANHOLE PIPE ENTRANCES

A. Description:

1. Material: Ethylene propylene rubber (EPDM).
2. Comply with ASTM C923.
3. Attachment: Stainless-steel clamp and hardware.

2.4 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. As specified in Section 03 11 00, Concrete Work.
2. Strength: Minimum 3,000 psi at 28 days.
3. Air entrained.
4. Finish: Rough troweled.

B. Concrete Reinforcement: As specified in Section 03 11 00, Concrete Work.

2.5 MANHOLES

A. Description:

1. As specified in Section 33 05 13 - Manholes and Structures.
2. Material: Reinforced precast or cast-in-place concrete.
3. Diameter: As shown in the Drawings.
4. Top: As shown in the Drawings.
5. Frames and Covers: Watertight cast iron.
6. Cover Inscription: "S".

2.6 CATCH BASINS AND AREA DRAINS

A. Construction:

1. Material: Reinforced concrete pipe sections.
 - a. Minimum compressive strength of 3,000 psi at 28 days.
 - b. Precast concrete inlets shall conform to ASTM C913.
2. Joints: Lipped male/female.
3. Nominal Interior Dimensions: As shown in the Drawings.

B. Lids and Frames:

1. Materials: Cast iron.

2. Lid:
 - a. Removable.
 - b. Design: Linear grill.
3. Nominal Lid and Frame Size: As shown in the Drawings.

2.7 CLEANOUTS

- A. Construction:
 1. Per details provided in the Drawings.
- B. Lids and Frames:
 1. Materials: Cast iron. Meet H2O load requirement.

2.8 MATERIALS

- A. Bedding and Cover:
 1. Pipe Bedding: Coarse Aggregate Material Type A1, 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 A1, 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 S2 as specified in Section 31 05 13, Soils for Earthwork.

2.9 MIXES

- A. Grout: As specified in Section 03 60 00, Grouting.

2.10 ACCESSORIES

- A. Underground Pipe Markers: As specified in Section 31 23 17, Trenching.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut, or excavation base is ready to receive Work.
- B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Correct over-excavation in accordance with Section 31 23 17, Trenching.
- B. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.
- C. Protect and support existing sewer lines, utilities, and appurtenances.
- D. Utilities:
 - 1. Maintain profiles of utilities.
 - 2. Coordinate with other utilities to eliminate interference.
 - 3. Notify Engineer if crossing conflicts occur.

3.3 INSTALLATION

- A. Bedding:
 - 1. Excavate pipe trench as specified in Section 31 23 17, Trenching.
 - 2. Excavate to lines and grades as indicated on Drawings, or as required to accommodate installation of utility.
 - 3. Pipe base shall be observed by Engineer prior to placement of the pipe.
 - 4. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.
 - 5. Provide sheeting and shoring as specified in Section 31 50 00, Excavation Support and Protection.
- 6. Placement:
 - a. Place bedding material at trench bottom.
 - b. Level materials in continuous layer not exceeding 6 inches compacted depth.
 - c. Compact to 95 percent of maximum density.

B. Piping:

1. Install pipe, fittings, and accessories according to standards listed below, and seal joints watertight.
 - a. PVC, HDPE, ABS: Comply with ASTM D2321.
 - b. Ductile Iron: Comply with AWWA C600.
 - c. Reinforced Concrete: Comply with ASTM C1479.
2. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.
3. Lay pipe to slope gradients and line where indicated.
4. Variations:
 - a. Maximum Variation from Indicated Line: 1/32-inch per inch of pipe diameter, but no more than 1/2-inch, providing that such variation does not result in a level or reverse-sloping invert.
 - b. Maximum Variation from Indicated Grade: 1/32-inch per inch of pipe diameter, but no more than 1/4-inch.
 - c. Variation in the invert elevation between adjoining ends of pipe, include fittings, shall not exceed 1/64-inch per inch of pipe diameter, or 1/2-inch maximum.
5. Begin at downstream end and progress upstream.
6. Assemble and handle pipe according to manufacturer's instructions, except as may be modified on Drawings or by Engineer.
7. Make straight field cuts without chipping or cracking pipe.
8. Keep pipe and fittings clean until Work has been completed and accepted by Engineer.
9. Assemble pipe joints in accordance with manufacturer's recommendations/specifications.
10. Cap open ends during periods of Work stoppage.
11. Lay bell and spigot pipe with bells upstream.
12. Backfill and compact as specified in Section 31 23 17, Trenching.
13. Do not displace or damage pipe when compacting.

14. Pipe Markers: As specified in Section 31 23 17, Trenching.

C. Joints:

1. Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gaskets shall be liberally lubricated with an approved type of vegetable oil soap.
2. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned.
3. Before the joint is fully "home," the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the pipe manufacturer.
4. If the gasket is found not to be in proper position, the pipes shall be separated, and the damaged gasket replaced.
5. The pipe is then forced "home" firmly and fully.
6. In its final position, the joint between the pipes shall not be deflected more than 1/2-inch at any point.

D. Connection to Existing Manholes:

1. Drilling:
 - a. Core drill existing manhole to clean opening.
 - b. Use of pneumatic hammers, chipping guns, and sledgehammers are not permitted.
2. Install watertight neoprene gasket and seal with non-shrink concrete grout.
3. Encasement:
 - a. Concrete encase new sewer pipe minimum of 24 inches to nearest pipe joint.
 - b. Use epoxy binder between new and existing concrete.
4. Prevent construction debris from entering existing sewer line when making connection.

E. Manholes:

1. Install manholes as specified in Section 33 05 13, Manholes.

F. Wye Branches and Tees:

1. Concurrent with pipe-laying operations, install wye branches and pipe tees at locations indicated on Drawings.
2. Use standard fittings of same material and joint type as sewer main.
3. Maintain minimum 5-foot separation distance between wye connection and manhole.
4. Use saddle wye or tee with stainless-steel clamps for taps into existing piping.
5. Mount saddles with solvent cement or gasket and secure with metal bands.
6. Lay out holes with template and cut holes with mechanical cutter.

G. Catch Basins

1. Form bottom of excavation clean and smooth, and to indicated elevation.
2. Cast-in-place Concrete Construction:
 - a. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe end sections.
 - b. Level top surface of base pad.
 - c. Sleeve concrete shaft sections to receive storm sewer pipe sections.
 - d. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.
3. Mount lid and frame level in grout, secured to top cone section to indicated elevation.

H. Backfilling:

1. Backfill around sides and to top of pipe as specified in Section 31 23 23, Fill.
2. Maintain optimum moisture content of bedding material as required to attain specified compaction density.

3.4 FIELD QUALITY CONTROL

- A. Request inspection by Engineer prior to and immediately after placing bedding.

B. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2. Pipe Testing: As specified in Section 33 01 30.13, Sewer and Manhole Testing.
3. Compaction Testing: See Section 31 23 17, Trenching for Compaction Testing requirements for piping trenches.

3.5 PROTECTION

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

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 & Transmission Valves.
- B. Section Includes:
 - 1. Resilient-seated gate valves.
 - 2. General duty gate valves smaller than 3 inches.

1.2 RELATED SECTIONS

- A. Section 33 11 10 - Water Utility Distribution & Transmission Piping
- B. Section 33 12 16 - Water Utility Distribution & Transmission Valves
- C. Section 33 13 00 - Testing and Disinfection of Water Utility Piping

REFERENCE STANDARDS

- D. 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).
- E. 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.
- F. American Water Works Association:
1. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
 2. AWWA C550 - Protecting Interior Coatings for Valves and Hydrants.
- G. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends.
 2. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
- H. 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. As required by Section 33 12 16, Water Utility Distribution & Transmission 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.
 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. American AVK
 - 2. American Flow Control.

2.3 GENERAL-DUTY GATE VALVES - SMALLER THAN 3 INCHES

- A. 2 inches and Smaller:
 - 1. MSS SP 80, Class 125.
 - 2. Body and Trim: ASTM B584, bronze.
 - 3. Bonnet: Union.
 - 4. Operation: Handwheel.
 - 5. Inside screw [with back-seating stem].
 - 6. Wedge Disc: Solid; ASTM B584, bronze.
 - 7. End Connections: Threaded.
- B. 2-1/2 inches to 3 inches:
 - 1. MSS SP 70, Class 125.
 - 2. Stem: Non-rising.
 - 3. Body: ASTM A126, cast iron.
 - 4. Trim: Bronze.
 - 5. Bonnet: Bolted bonnet.
 - 6. Handwheel, outside screw and yoke.
 - 7. Wedge Disc: Solid, with bronze seat rings.
 - 8. End Connections: ASME B16.1, ASME B16.5, ASME B16.42, flanged.

2.4 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 & Transmission 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 23.18 - BUTTERFLY VALVES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes butterfly valves for use in buried service. Coordinate with Section 33 12 16, Water Utility Distribution & Transmission Valves.
- B. Section Includes:
 - 1. Rubber-seated butterfly valves.

1.2 RELATED SECTIONS

- A. Section 33 11 10 - Water Utility Distribution & Transmission Piping
- B. Section 33 12 16 - Water Utility Distribution & Transmission Valves
- C. Section 33 13 00 - Testing and Disinfection of Water Utility 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.
- 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 B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. American Water Works Association:

1. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm).
2. 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 & Transmission 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 RUBBER-SEATED BUTTERFLY VALVES

- A. Description:
 1. Comply with AWWA C504, Class 150B.
 2. Minimum Pressure Rating:
 - a. 12-inch (300-mm) Diameter and Smaller: 200 psig.
 - b. 16-inch (400-mm) 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, unless shown otherwise. 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 C504 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. Bubble-tight at the rated pressure for bi-directional flow.
- 7. Style: Wafer.
- 8. Shaft: Self-lubricating. One-piece, through-shaft construction.
 - a. Type 304 stainless steel confirming to ASTM A-276.
 - b. Shall be standard self-adjusting split V packing.
 - c. Shall be of a design allowing replacement without removing the valve shaft.
- 9. Seats: Mounted on body for valves 24 inches and smaller; field replaceable (mechanically retained in a machined groove) for valves larger than 24 inches.
- 10. Packing: Replaceable without dismantling valve.
- B. Operation:
 - 1. Open counterclockwise, unless otherwise indicated in the Drawings.
 - 2. Operators shall be of the traveling nut, self- locking type and shall be designed to hold the valve in any intermediate position between full open and fully closed without creeping or fluttering.
 - 3. Buried Valves: All buried valves shall be provided with 2-inch square operating nuts.
- C. Materials:
 - 1. Body: ASTM A126, cast iron or ASTM A536, ductile iron, Integrally cast flanged or mechanical end joints.

2. Shaft: Stainless steel.
 3. Disc: ASTM A126, cast iron or ASTM A536, ductile iron;
 4. Seats: Resilient, replaceable, Buna-N.
 5. Seating Surfaces: Type 316 stainless steel.
 6. Bearings:
 - a. Sleeve: Corrosion-resistant and self-lubricating.
- D. Manufacturers:
1. Henry Pratt Company.
 2. Mueller Company.
 3. Dezurik.

2.3 SOURCE QUALITY CONTROL

- A. Testing: Test butterfly valves according to AWWA C504.

PART 3 EXECUTION

3.1 INSTALLATION

- A. As required by Section 33 12 16, Water Utility Distribution & Transmission Valves.
- B. Install according to manufacturer's instructions.

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. Ball valves, 2 inches and under.

1.2 RELATED SECTION

- A. Section 33 11 10 - Water Utility Distribution & Transmission Piping
- B. Section 33 12 16 - Water Utility Distribution and Transmission 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 3-inch diameter, as shown on Plans.
 2. Has features of both an air release valve and an air & vacuum valve.
 3. Ductile-iron body & cover for air & vacuum valve. Comply with ASTM A536, 60-40-18.
 4. Orifice seat design: combination of bronze or stainless steel and E.P.D.M rubber.
 5. Rolling Seal Mechanism for air release valve with ¼-inch NPT outlet.
 6. Fusion bonded epoxy coating.
 7. 2" diameter (nominal) air valve to be provided with inlet for NPT threaded connection and special ring gasket for sealing NPSM outlet for direct NPT threaded connection to vent piping per Plans.

8. 3" diameter valve to be provided with standard flanged inlet and special ring gasket for sealing NPSM outlet for direct NPT threaded connection to vent piping per Plans.

9. Max design working pressure: 16 Bar (approx. 232 psig.)

B. Manufacturers:

1. ARI - Series D-060-C HF, or approved equal.

2.3 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.

2.4 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.

END OF SECTION

SUPPLEMENTARY INFORMATION

Asbestos Program Guidance

How to Remove Nonfriable Asbestos Cement Pipe

A Guide for General Contractors to Meet DEQ Rules

The Oregon Department of Environmental Quality regulates the removal, handling, and disposal of asbestos-containing materials during renovation and demolition projects. Asbestos-containing material means any material containing more than one percent asbestos. Nonfriable asbestos material is asbestos-containing material that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure or by the forces expected to act on the material in the course of demolition, renovation, transportation or disposal. This document provides guidance for removing nonfriable asbestos cement pipe.

Disclaimer

Asbestos is a hazardous air pollutant that is known to cause cancer. There is no safe level of exposure. DEQ recommends hiring a [DEQ-licensed asbestos abatement contractor](#) to perform any asbestos removal projects, including nonfriable projects. If asbestos-containing material is not handled properly, it can become friable and release asbestos fibers into the air. Friable asbestos abatement projects must be performed by a DEQ-licensed asbestos abatement contractor, with a limited exception. Homeowners may perform an asbestos abatement project in the single unit private residence that they live in. They must handle and dispose of all asbestos-containing material in compliance with DEQ rules.

This guidance document provides information only and does not fully address, and must not be interpreted in any way as fully addressing, all products and/or [materials that may contain asbestos](#) or all procedures that may be used to safely remove asbestos-containing material. DEQ assumes no liability or responsibility for injuries, illnesses, health issues, or other related problems arising from any untrained person attempting to remove and dispose of asbestos without using a DEQ-licensed asbestos abatement contractor. If you undertake an asbestos removal project that is not performed by a DEQ-licensed asbestos abatement contractor, you assume all risks and liabilities that result from such a project.

Before you start

All applicable asbestos abatement rules found in [Oregon Administrative Rules 340, Division 248](#) must be followed. If you have questions, contact asbestos program staff (see contact information below).

If the project is taking place in a school (K-12), you must comply with the [Asbestos Hazard Emergency Response Act](#) regulations from the U.S. Environmental Protection Agency. Contact the [EPA's regional office](#) at 800-424-4372 for current regulations and policy information.

Oregon Occupational Safety and Health also has rules for working safely with asbestos-containing materials. Please be certain that you comply with Oregon OSHA regulations if you are performing any asbestos removal or the renovation and maintenance of buildings and structures that contain asbestos. Contact [Oregon OSHA](#) at 503-378-3272 or toll-free at 800-922-2689 for current rule and policy information.

How to determine if a material contains asbestos

The only way to determine if a material contains asbestos is to take a sample and have it analyzed by a [laboratory](#). Alternatively, you may presume the material contains asbestos and treat it accordingly.



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Department of
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Quality

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Contact: Hillarie Sales

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Asbestos Program Guidance

What is asbestos cement pipe?

Asbestos cement pipe, or AC pipe, was used widely in the mid-1900's in potable water distribution systems and in sewer lines. Since the lifetime of AC pipe is approximately 70 years, many projects to update this infrastructure involve removal of this product. The cement acts as a binder that holds the asbestos fibers within a solid matrix. This prevents asbestos fibers from being released easily, unless mishandled, damaged, or in badly weathered condition. When kept intact, AC pipe is considered nonfriable.

Removing nonfriable AC pipe

The removal of nonfriable asbestos-containing materials in good condition is exempt from some DEQ rules. You **do not** need to be a DEQ-licensed asbestos abatement contractor or a DEQ-certified asbestos worker to perform nonfriable asbestos removal. When removing AC pipe, the pipe must remain intact.

Notification

File a DEQ [nonfriable notification form](#), known as an ASN-6 form, for removal of nonfriable asbestos materials and pay the appropriate fee. The DEQ Business Office must receive the notification form at least five days before the start date of the nonfriable asbestos abatement project. In emergency situations, DEQ may grant a waiver of the five-day waiting period. For more information contact [asbestos program staff](#).

Regulated Area

The regulated area must be established by the person performing the asbestos abatement project. It includes the work area and any adjoining area where asbestos-containing waste material generated from the project site is securely packaged and stored. The regulated area must restrict access to authorized personnel only, and be demarcated with prominent warning signs along the perimeter that state, in bold, all-capital letters and separated as shown here:

DANGER

ASBESTOS

MAY CAUSE CANCER

ASBESTOS CAUSES DAMAGE TO LUNGS

AUTHORIZED PERSONNEL ONLY

Safety Tips

Even under the best conditions, these projects are physically demanding and potentially dangerous. Oregon OSHA provides [guidance for required safety equipment](#) (Personal Protective Equipment or PPE) to perform asbestos removal. The following are some of the challenges to consider:

- Breathing through a respirator is difficult and places extra stress on the heart and lungs.
- Coveralls can be hot and hard to move around in.
- Work may involve ladders since some materials are located in high areas.
- Goggles and safety glasses reduce visibility and field of vision.
- Care must be taken around electric wires because water will be used to keep asbestos materials wet.
- The work area will be slick from wetting and may be a slipping or tripping hazard.

Options for removing nonfriable AC pipe

AC pipe must be removed, handled and disposed of in a manner that keeps the material intact to be



State of Oregon
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Contact: Hillarie Sales

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Asbestos Program Guidance

considered nonfriable. The method of removal cannot crumble, pulverize or reduce the material to dust. Sanding, sawing, grinding, chipping or use of power tools is not allowed. The pipe must be kept adequately wet during removal, packaging and disposal. Wetting minimizes asbestos fibers from being released.

Here are some examples of proper methods to remove AC pipe:



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	<p>1. Snap cutters</p> <p>Snap cutters, also called “squeeze-and-pop” equipment, use cutting wheels mounted in a chain wrapper around the pipe barrel. Hydraulic pressure, applied by means of a remote, pneumatically or manually operated pump, squeezes the cutting wheels into the pipe wall until the cut is made.</p>
	<p>2. Carbide-tipped blade cutters</p> <p>Blade cutters are frame adjustable to the circumference of the pipe and have a number of self-tracking rollers that align one or more carbide-tipped cutting blades. Due to the relatively low mechanical input and clean cutting action, hand operated blade cutters do not produce significant amounts of airborne asbestos dust.</p>
	<p>3. Manual field lathes</p> <p>Manual field lathes are designed to end-trim and re-machine rough pipe barrels to factory-machined end profiles. The lathe consists of an adjustable, self-aligning arbor inserted into the pipe bore (which acts as a mandrel upon which the turning handle operates), a screw-fed turning frame, carbide machining blades and manual (hand or ratchet) turning handles.</p>
	<p>4. Wet tapping AC pipe</p> <p>Pressure or “wet” tapping for service connections is performed in the trench while the pipe is under pressure. The equipment (manual driven) is affixed to the pipe by means of a chain yoke. A combination boring-and-inserting bar drills and taps the pipe wall and inserts a corporation stop or pipe plug. The pressure chamber, which protects against water leakage, also catches the asbestos-cement chips, so this is essentially a dust-free operation.</p>

Asbestos Program Guidance

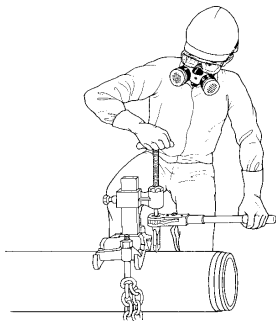


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5. Dry tapping AC pipe

Non-pressure or “dry” tapping for service connections may be performed in or out of the trench. The equipment is affixed to the pipe by means of a chain yoke. Separate drills and taps or a combination tool is used to drill and tap the pipe wall.

Corporation stops or other connections may then be affixed to the pipe.

Waste Disposal

AC pipe waste must be kept adequately wet and packaged in leak-tight containers such as two six-mil plastic bags with the asbestos hazard label, or within similar leak-tight packaging with the asbestos hazard label that states the following in bold, all-capital letters and separated as shown here:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

AVOID BREATHING AIRBORNE

ASBESTOS FIBERS

Prior to transport, each of the asbestos-containing waste packages must have a label attached with the name of the generator (person doing the removal) and the address from where the AC pipe was removed. The waste packages must be labeled prior to removal from the regulated area.

The AC pipe waste must be disposed of at a [landfill permitted to accept asbestos waste](#) and must be accompanied by a completed [waste shipment report](#), known as an ASN-4, at the time of disposal. Contact the landfill prior to delivering the AC pipe waste. Landfills can be more stringent and may only accept asbestos waste by appointment.

If the material becomes friable

If the AC pipe becomes damaged or is badly weathered, it is considered friable and may release asbestos fibers. If the AC pipe becomes friable, stop work immediately, adequately wet the material and cover with six-mil plastic or equivalent, and promptly contact a DEQ-licensed asbestos abatement contractor. ***Friable asbestos materials must be removed by a DEQ-licensed asbestos contractor using certified workers.***

A [DEQ friable notification form](#), known as an ASN-1 form, for the abatement of friable asbestos and the appropriate fee must be filed with DEQ. The DEQ Business Office must receive notification at least 10 days before the start date of the asbestos abatement project. In emergency situations, DEQ may grant a waiver of the 10-day waiting period. For more information [contact asbestos program staff](#).

Additional information

Visit the DEQ Asbestos Program website here: <https://go.usa.gov/xdG4K>

Asbestos Program Guidance

Find all DEQ's asbestos requirements in [Oregon Administrative Rules 340, Division 248](#). People handling asbestos must also follow other state and local government requirements, including requirements of Oregon OSHA.

If you have questions about the rules, contact the regional asbestos program office listed below.

If asbestos-containing material is disturbed or mishandled, it may expose workers or the public to asbestos fibers. Violations of asbestos rules and statutes may result in civil penalties.

Asbestos Program Contacts

Office	Address	Phone	Counties
Portland	700 NE Multnomah St. Suite 600 Portland, OR 97232	503-229-5982 or 800-452-4011	Clackamas, Clatsop, Columbia, Multnomah, Tillamook, Washington
Salem	4026 Fairview Industrial Dr. Salem, OR 97801	503-378-5086 or 800-349-7677	Benton, Lincoln, Linn, Marion, Polk, Yamhill
Medford	221 Steward Ave. Ste. 201 Medford, OR 97501	541-776-6107 or 877-823-3216	Jackson, Josephine, Eastern Douglas County
Coos Bay	381 N Second St. Coos Bay, OR 97420	541-269-2721, Ext. 222	Coos, Curry, Western Douglas County
Bend	475 NE Bellevue Dr. Suite 110 Bend, OR 97701	541-633-2019 or 866-863-6668	Crook, Deschutes, Harney, Hood River, Jefferson, Klamath, Lake, Sherman, Wasco
Pendleton	800 SE Emigrant Ave. Suite 330 Pendleton, OR 97801	541-278-4626 or 800-304-3513	Baker, Gilliam, Grant, Malheur, Morrow, Umatilla, Union, Wallowa, Wheeler
Lane Regional Air Protection Agency	1010 Main St. Springfield, OR 97477	541-736-1056	Lane



State of Oregon
Department of
Environmental
Quality

Asbestos Program
700 NE Multnomah St.
Suite 600
Portland, OR 97232
Phone: 503-229-5696
800-452-4011
Fax: 503-229-6124
Contact: Hillarie Sales

www.oregon.gov/DEQ

*DEQ is a leader in
restoring, maintaining
and enhancing the
quality of Oregon's air,
land and water.*

Alternative formats

DEQ can provide documents in an alternate format or in a language other than English upon request. Call DEQ at 800-452-4011 or email deqinfo@deq.state.or.us.



ASN 6

DEQ Notification Form Nonfriable Asbestos Abatement

For DEQ use only
Date Received: _____
Amount Received: _____
Check Number: _____
Project Number: _____

ATTENTION

CONTRACTORS/OPERATORS: This notification is not complete unless it is accompanied by the required \$100.00 fee and is submitted 5 days prior to the start date. To inquire about a waiver of the 5-day waiting period or for other information call 1-800-452-4011 for the phone number of your local regional DEQ office.

EMERGENCY (Emergency notifications require a 50% fee increase)

Emergency Approved by (list DEQ staff): _____ **Date:** _____

List the Reason for the Emergency _____

(i.e. Fire or Water Damage, Dangerous Structure, etc.)

Is this a revision to a previous notification? Yes _____ Revision# _____ No _____

Start date of project: _____ End date of project: _____

Days of week and hours to be worked: _____

Project site name: _____ Building Owner: _____

Project address: _____

(Include Apt #, Floor #, Bldg #, school name or any other pertinent site location information)

City: _____ County: _____ State: _____ Zip: _____

Was a survey performed or samples collected: Yes: _____ No: _____ By whom? _____

Type of nonfriable material to be removed: _____

Amount of nonfriable asbestos material to be removed. Square or Linear footage: _____

Contractor/Operator name: _____ Phone: _____

Contractor/Operator address: _____

City: _____ County: _____ State: _____ Zip: _____

CCB registration number: _____ Competent Person: _____

Waste disposal site: _____

Site address: _____

City: _____ County: _____ State: _____ Zip: _____

Waste hauler: _____ Phone: _____

Sign below and send this form with the appropriate fee to the DEQ Business Office at 700 NE Multnomah Street Suite #600, Portland, OR 97232. Make checks payable to "DEQ"

Name of owner, operator or contractor: _____

Name: _____ Phone: _____

(PLEASE PRINT)

Signature: _____ Date: _____

I certify that the information contained in this notification are true and correct to the best of my knowledge and belief.

CAUTION! If the material being removed is handled in a manner that causes it to become friable (crumbled, pulverized, or reduced to dust), then only a DEQ licensed asbestos abatement contractor may perform the removal work. Submit nonfriable notifications and fees in accordance with OAR 340-248-0260. Revisions to notifications may be emailed or faxed to the appropriate DEQ regional office. Fax numbers: Portland at 503-229-6957, Bend at 541-388-8283, Pendleton 541-278-0168, Salem at 503-378-4196, Medford at 541-776-6262 or Coos Bay 541-269-7984.

ASN4

Asbestos Waste Shipment Reporting Form

Please Print or Type. If you have questions, contact your local DEQ Regional Office in Portland 503-229-5364, Salem 503-378-5086, Medford 541-776-6107, Coos Bay 541-269-2721 Ext. 222, Bend 541-633-2019, or Pendleton 541-278-4626.

Waste Generator: (Contractor, Facility, or Operator)

1. Asbestos removal site name and address: _____

Street	City/State	County	Zip
--------	------------	--------	-----

 Contact person: _____ Phone: _____
2. Contractor/Operator's name and address: _____ Phone: _____

Street	City/State	County	Zip
--------	------------	--------	-----
3. Waste disposal site: _____ Phone: _____

Street	City/State	County	Zip
--------	------------	--------	-----
4. Describe asbestos materials: _____
5. Containers: _____ Number: _____ Type: _____
6. Total quantity (cubic yards): _____

7. **Operator's Certification:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packaged, marked and labeled, and are in all respects in proper condition for transport according to all government regulations. All movement of this asbestos-containing material is recorded on this Waste Shipment Record Form.

Name: _____ Company: _____
 Signature: _____ Date: _____
 Address: _____ Phone: _____

Transporter(s):

8. Transporter #1: (Acknowledgment of receipt of materials)
 Agent: _____ Company: _____
 Address: _____ Phone: _____
 Signature: _____ Date: _____
9. Transporter #2: (Acknowledgment of receipt of materials)
 Agent: _____ Company: _____
 Address: _____ Phone: _____
 Signature: _____ Date: _____

Disposal: (Certification of receipt of asbestos materials covered by this manifest, except as noted in item 11 below.)

10. Waste Disposal Site: _____
 Name and Title: _____ Date: _____
 Signature: _____ Phone: _____
11. **Discrepancy Space:** (Add attachments as needed): _____

Instructions for using ASN 4 Asbestos Waste Shipment Reporting Form

This form is to be used as a permanent record for documenting asbestos-containing waste materials from removal site to final disposal. The Oregon Department of Environmental Quality (DEQ) regulation that applies to asbestos waste disposal is found in OAR 340-248-0280.

Waste Generator Section

(Numbers below correspond to numbers on the front of this Form)

1. Enter the name and address of the site where the asbestos waste was generated. Enter the name and phone number of the contact person for the contractor, facility, or operator of the asbestos waste generation site.
2. Enter the name, phone number and address of the person performing the asbestos abatement.
3. Enter the name, phone number and address of the disposal site that the waste is taken to.
4. Describe the materials being removed.
(i.e. pipe insulation, flooring, roofing, popcorn ceiling material, HVAC system insulation, Nonfriable asbestos.)
5. List the total number of containers and their type. Also enter one of the following container codes used in transporting each type of asbestos material. (Specify any other type of container used if not listed below):

DM	Metal drums, barrels
DP	Plastic drums, barrels
BA	6 mil. plastic bags or wrapping
NFC	Leak-tight containerization for Nonfriable asbestos waste material.

6. Give an estimate of the total quantity of cubic yards of material.
7. Print clearly the name of the company and their authorized signer. This section of the form must be signed and dated.

Note: The waste generator must retain a copy of the completed disposal form.

Waste Transporter Section

8. Transporter #1: Acknowledgment of receipt of asbestos waste materials. Print agent and company name, then sign and date.
9. Transporter #2: Acknowledgment of receipt of asbestos waste materials. Print agent and company name, then sign and date.

Note: If there are more than two transporters, attach a new waste shipment form.

Disposal Site Section

10. List the name of the waste disposal site, print the name, title and phone number, then sign and date form. This certifies that you have received the asbestos material covered by this manifest.
11. Discrepancy space. This space is used if there is a discrepancy between the amount of the material received by the landfill and the amount of material listed on the waste shipment report form.

Note: The waste disposal site operator must retain a copy of this form.

In addition, asbestos waste disposal regulations require that the Waste Disposal Site operators take the following actions:

- Send a copy of the completed and signed Waste Shipment Report Form to the Waste Generator as soon as possible, but no later than 30 days after the waste has been received at the disposal site.
- Notify DEQ immediately by telephone of improperly enclosed or uncovered waste. Submit a written report to DEQ the following working day, along with a copy of the Waste Shipment Report Form.
- If you discover a discrepancy between the quantity of waste designated on the Waste Shipment Report Form and the quantity of waste actually received, attempt to reconcile the discrepancy with the Waste Generator. You must report, in writing, to DEQ within 15 days after receiving the waste any discrepancies that cannot be reconciled. Submit a copy of the Waste Shipment Report Form with this report.



State of Oregon Department of Environmental Quality

Oregon Landfills and Transfer Stations Accepting Asbestos Waste

The following landfills and transfer stations are permitted by the Oregon Department of Environmental Quality to accept asbestos waste. Oregon Administrative Rule 340-248-0280(6) requires that you notify the landfill prior to disposal. DEQ suggests you contact the landfill at least 24 hours prior to disposal.

Landfills Accepting Asbestos Waste		
Landfill Name	County	Address/Phone
Northwest Region		
Hillsboro Landfill	Washington	3205 SE Minter Bridge Road Hillsboro, OR 97123 503-640-9427
Tillamook Transfer Station	Tillamook	1315 Ekloff Rd. Tillamook, OR 97141 503-842-2431
Western Region		
Brookings Transfer Station	Curry	17498 Carpenterville Rd Brookings, OR 97415 541-469-2425
Brown's Island Demolition Landfill	Marion	2895 Faragate Street South Salem, OR 97306 503-588-5169
Coffin Butte Landfill	Benton	28972 Coffin Butte Road Corvallis, OR 97330 541-745-5792
Dry Creek Landfill	Jackson	5500 Highway 140 White City, OR 97503 541-779-4161
Roseburg Landfill	Douglas	384 McClain West Avenue Roseburg, OR 97471 541-440-4487
Schooner Creek Public Transfer Station	Lincoln	367 S. Anderson Creek Rd. Lincoln City, OR 97367 541-994-5555
Short Mountain Landfill	Lane	84777 Dillard Access Road Eugene, OR 97405 541-682-4120

Eastern Region		
Ant Flat Landfill	Wallowa	Ant Flat Rd. Enterprise, OR 97828 541-426-3332
Baker Sanitary Landfill	Baker	39144 West Sutton Creek Rd Baker City, OR 97814 541-523-2626
Burns-Hines Disposal Site	Harney	1550 W Monroe Burns, OR 97720 541-573-6441
Chemical Waste Management of the Northwest Landfill	Gilliam	17629 Cedar Springs Lane Arlington, OR 97812 541-454-2030
Columbia Ridge Landfill	Gilliam	18177 Cedar Springs Lane Arlington, OR 97812 541-454-2030
Crook County Landfill	Crook	5601 SW Houston Lake Rd Prineville, OR 97754 541-447-2398
Finley Buttes Landfill	Morrow	73221 Bombing Range Rd Boardman, OR 97818 541-481-2233
Humbert Refuse Landfill	Umatilla	79378 Gerking Flat Rd Athena, OR 97813 541-938-4188
Klamath Falls Landfill	Klamath	801 Old Fort Rd Klamath Falls, OR 97601 541-883-5121 (Option 7)
Knott Landfill	Deschutes	61050 SE 27 th Street Bend, OR 97702 541-317-3163
Thomas Creek Road Landfill aka Lake County Landfill	Lake	Thomas Creek Rd. Lake View, OR 97630 541-947-6043
Wasco County Land fill	Wasco	2550 Steele Road The Dalles, OR 97058 541-296-4082

Alternative formats: DEQ can provide documents in an alternate format or in a language other than English upon request. Call DEQ at 800-452-4011 or email deqinfo@deq.state.or.us.


Foundation Engineering, Inc.

Professional Geotechnical Services

Memorandum

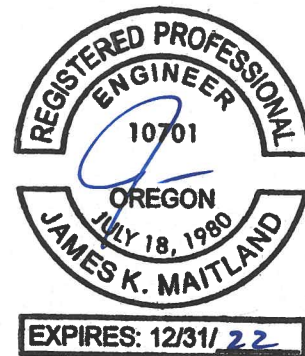
Date: May 4, 2021

To: Justin Luce, P.E.
Murraysmith

From: Mallory L. McAdams, E.I.T.
James K. Maitland, P.E., G.E.

Subject: Geotechnical Investigation

Project: NE Stephens Street & NE Hooker Road Crossing
Project No.: 2211042



We have completed the requested geotechnical investigation for the above-referenced project. Our findings and recommendations are detailed below.

BACKGROUND

The City of Roseburg is preparing to install a new, 24-inch diameter, water transmission main from NE Hooker Road, south to Isabell Avenue along the west side of the southbound lane of NE Stephens Street. A trenchless waterline crossing under Davis Creek is planned where the creek crosses beneath NE Stephens Street. The site location is shown in Figure 1A (Appendix A).

Murraysmith is the lead designer and plans to put the project out to bid in the coming months. Murraysmith retained Foundation Engineering, Inc. to complete a geotechnical investigation to assist contractors bidding on the project. Our scope of work was outlined in a proposal dated April 8, 2021, and included one boring, laboratory testing, and preparation of a geotechnical data report. Our work was authorized by the signed task order.

There are numerous values in geotechnical investigations that are approximate, including calculated values, measured lengths, soil layer depths and elevations, and strength measurements. For brevity, the symbol "±" is used throughout this report to represent the words approximate or approximately.

FIELD EXPLORATION

One boring (BH-1) was drilled in the center turn lane of NE Stephens Street, ±15 feet south of two existing CMP culverts, which carry the flow for Davis Creek (Figure 2A, Appendix A). The boring was completed on April 16, 2021, using a CME-75, truck-mounted drill rig with mud-rotary drilling techniques. The boring extended to a depth of ±40.2 feet below the pavement surface. The approximate boring location is shown in Figure 2A.

Samples were obtained at 2½-foot intervals to a depth of ±30 feet and at 5-foot intervals thereafter. Disturbed samples were obtained using a split-spoon sampler in conjunction with the Standard Penetration Test (SPT). The SPT provides an indication of the relative stiffness, or density, of the foundation soils. The number of blows required to drive the sampler the final 12 inches of an 18-inch long drive is recorded and represents the standard penetration resistance, or N-value, in blows per foot (bpf). A relatively undisturbed sample was also attempted at a depth of ±7.5 feet using a thin-walled Shelby tube. However, due to the composition of the soil, no sample was recovered.

The borehole was continually logged during drilling. The final log (Appendix B) was prepared based on a review of the field log and laboratory test results, and an examination of the soil samples in our office. Upon completion of drilling, the borehole was backfilled in accordance with Oregon Water Resources Department guidelines and capped with asphaltic concrete (AC) cold patch and gravel to match the existing conditions.

SITE AND SUBSURFACE CONDITIONS

Site Conditions

The project site and NE Stephens Street in the vicinity of the boring are relatively flat. Davis Creek flows from east to west beneath NE Stephens Street via two, 38x57-inch CMP culverts.

The creek beyond the west road shoulder is incised ±5.5 feet below the road grade. The creek gradient is relatively flat and continues west beneath the railroad trestle, located ±55 feet to the west. A 24-inch diameter storm drain empties into Davis Creek west of NE Stephens Street, ±20 feet south of the two CMP culverts. The water within Davis Creek was relatively stagnant with slow flow at the time of our exploration.

Photos 1 and 2 (Appendix A) show the planned crossing and the existing CMP culverts.

Subsurface Conditions

A general discussion of the materials encountered in the boring is presented below. Detailed descriptions of the subsurface conditions encountered in the boring are summarized on the boring log (Appendix B). A roadway surface elevation at BH-1 of ±El. 542.5 was estimated from plans provided by Murraysmith (Murraysmith, 2021).

Pavement Section. BH-1 encountered a pavement section consisting of ± 9 inches of AC over medium dense crushed gravel (base rock) to a depth of ± 2.5 feet.

Fill. The pavement section is underlain by medium dense to dense sandy gravel and cobbles extending to ± 4.0 feet (\pm El. 538.5). The cobbles are up to ± 6 inches in diameter. Based on the depth and composition, we anticipate this material is fill used to raise the native grade to the present road elevation.

Alluvium. Fine-grained alluvium extends below the pavement section and fill. The alluvium consists predominately of medium to high plasticity clay with some silt to ± 22.5 feet (\pm El. 520), followed by medium to high plasticity silty clay with varying amounts of fine sand to ± 37.0 feet (\pm El. 505.5), the approximate bedrock surface. SPT N-values recorded in the alluvium ranged from 5 to 11 bpf, suggesting a medium stiff to stiff consistency.

Sandy Siltstone. Very weak (R1) sandy siltstone extends below the alluvium to ± 40.2 feet (\pm El. 502.3), the maximum depth of the boring. The sandy siltstone is dark grey and slightly weathered. Practical sampling refusal was encountered in the first 2 inches of the sample attempt at ± 40 feet.

Surface Water and Groundwater

Mud-rotary drilling techniques precluded an accurate determination of the groundwater level in the boring at the time of drilling. However, the water level in Davis Creek at the west shoulder of NE Stephens Street was ± 5.5 feet below the road surface at the time of our exploration on April 16, 2021.

Based on the subsurface conditions, we anticipate the groundwater level in the immediate area fluctuates seasonally and will closely match the water level in Davis Creek.

LABORATORY TESTING

The laboratory testing included moisture contents, percent fines, and Atterberg limits tests to help classify the soils according to the Unified Classification System (USCS) and estimate their overall engineering properties. The test results are summarized in Table 1C (Appendix C). Non-tested samples were visually classified in accordance with ASTM D 2487 and ASTM D 2488. USCS symbols shown on the boring logs for untested samples should be considered approximations.

The test results indicate moisture contents ranging from ± 24.7 to 37.8%, suggesting the foundation soils are typically moist to wet. The moisture content percentages are also shown on the appended boring log.

A percent fines test was completed on the alluvium at a depth of ± 20 feet. The test indicates 80.7% fines, suggesting the clay is sandy at this depth.

The Atterberg limits tests indicate the soil from ± 12.5 to 36.5 feet has a Liquid Limit (LL) range of 48 to 56 and a Plasticity Index (PI) range between 21 and 31. These limits correspond to USCS classifications CL and CH.

DISCUSSION OF GEOTECHNICAL CONSIDERATIONS AND RECOMMENDATIONS

The planned waterline will be installed in the west, southbound lane of NE Stephens Street. Plans provided by Murraysmith (2021) indicate the portion of the water line crossing under Davis Creek will include a 36-inch diameter casing with an invert elevation of El. 527.58 (i.e., ± 14.9 feet below the road surface elevation). Trenchless installation is planned for the undercrossing, which will include a launching pit south of the existing CMP culverts and a receiving pit north of the culverts. The existing roadway at the location of the planned launching pit lies at \pm El. 542.5. We assume the launching and receiving pits will extend ± 3 feet below the invert elevation (i.e., \pm El. 524.5), corresponding to ± 18 feet below the roadway elevation.

Anticipated Subsurface Conditions

The excavations for the launching and receiving pits are expected to encounter a pavement section followed by gravel and cobbles (fill) to ± 4 feet. From ± 4 feet to the anticipated bottom of the excavation, the pits are expected to encounter fine-grained, medium to high plasticity clay with some silt and sand. SPT N-values of 8 to 11 bpf were recorded in the clay, indicating an undrained shear strength ranging from ± 0.5 to 1.0 tons/ft² (tsf).

Within the planned pipe zone, the boring encountered predominately medium stiff to stiff, medium to high plasticity clay with some silt and varying amounts of sand. The plans indicate there will be 6 feet of clearance between the existing CMP culverts and the top of the steel casing.

Sandy siltstone (bedrock) was encountered in the boring at a depth of ± 37 feet (\pm El. 505.5). The bedrock is slightly weathered and very weak (R1). R1 rock is defined as having an unconfined compressive strength (q_u) between 100 and 1,000 psi. However, harder rock may be encountered in some locations. Based on the depth to bedrock, we anticipate bedrock will not impact the installation of the water line or the excavations for the launching or receiving pits.

Groundwater is anticipated to closely match the level of Davis Creek. Infiltration testing was not included under our current scope of work. However, the clayey soils encountered in the boring are expected to have low permeability. Based on the plasticity of the soil, we anticipate it has a hydraulic conductivity on the order of 10^{-7} to 10^{-8} cm/s.

Loss of drilling fluid circulation, sidewall caving, and other difficulties were not reported by the drillers. Additionally, no obstructions (i.e., boulders or logs) were encountered during drilling. None of the conditions encountered in the boring within the planned pipe zone should preclude auger, bore-and-jack, or horizontal directional drilling methods.

Excavation and Shoring for Launching and Receiving Pits

Excavation of the existing roadway and underlying subgrade will be required to complete the launching and receiving pits. The excavations are expected to extend through fill and native clayey soil and will terminate in medium stiff to stiff clay with some silt and sand.

The means and methods for the excavation, shoring, and dewatering of the launching and receiving pits should be selected by the contractor. The design of the shoring system should be completed by a qualified engineer licensed in Oregon. A discussion of the soil parameters and recommendations for the design of shoring (by others) is provided below.

Excavation and Shoring. It is the contractor's responsibility to maintain stable cut slopes and provide the necessary cut slopes, benching, or shoring as required by OR-OSHA. The excavations for the launching and receiving pits will extend through predominately clayey soils corresponding to an OR-OSHA Soil Type B soil. However, the soil will be susceptible to softening when wet and may degrade to a Type C soil during construction. The coarse-grained fill underlying the pavement section corresponds to an OR-OSHA Type C soil.

For open excavations, OR-OSHA recommends maximum allowable cut slopes of 1:1 (H:V) for Type B soil and 1½:1 (H:V) for Type C soil. These slopes assume the excavation is dewatered. The appropriate soil types will need to be confirmed based on the conditions at the time of construction.

We anticipate the cut slopes will not be practical due to the proximity of the pits to existing structures and utilities, and the potential impact to the existing roadway. Therefore, the contractor should plan to provide shoring to protect workers and adjacent facilities from sloughing and caving sidewalls. We anticipate an internally-braced sheet pile cofferdam or sliding rail shoring system will be the most practical. A slide rail system typically proves less intimate contact with the excavated sidewalls. Therefore, the risk of spalling or caving and damage to the roadway pavement is higher with this type of system. As a result, a braced sheet pile cofferdam is recommended to provide intimate contact with the excavated sidewalls and prevent damage to the roadway pavement.

Due to the high plasticity of the soil, it should be assumed limited embedment of the sheet piles will be achieved with a vibratory hammer and an impact hammer will be required for additional embedment.

Dewatering. Shallow groundwater is expected year-round due to the proximity to Davis Creek. We anticipate it will not be practical to draw down the groundwater outside the shoring due to the proximity of the creek. Therefore, we recommend assuming a nominal groundwater depth of 5.5 feet (El. 537) for the shoring design. However, due to the assumed permeability of the soil, we anticipate relatively slow infiltration will occur in the excavations that could be contained with sumps or pumps.

Due to the low permeability of the subgrade soils, dewatering external wells are not expected to be effective. If dewatering is needed, internal sumps and pumps may be used to collect and dispose of infiltration or ponded water in the bottom of the excavations.

Lateral Earth Pressure for Temporary Shoring. Lateral earth pressures for the design of the temporary shoring were established based on the soil profile encountered in BH-1. Table 1 summarizes the recommended soil parameters.

Table 1. Recommended Design Parameters for Shoring Design

Material	Parameter	Value
Fill	ϕ	34°
	γ_m	125 pcf
Clay some silt (CH)	PI	31
	N-value	5 to 11 bpf
	Cohesion, c	±1,000 to 2,000 psf
	ϕ	0°
	γ_m	110 pcf
	γ_b	47.6 pcf
	Groundwater Elevation	El. 537

Figure 3A (Appendix A) provides a lateral earth pressure diagram for the design of the temporary shoring (by others). The apparent earth pressure distribution shown on the figure is based on soft to medium stiff clay (Peck, 1969) and the recommended design parameters shown in Table 1. Groundwater was also included outside of the cofferdam below 5.5 feet (i.e., El. 537). Lateral earth pressures on the cofferdam walls due to surface surcharge pressures from construction equipment should also be included in the shoring design.

VARIATION OF SUBSURFACE CONDITIONS, USE OF THIS REPORT, AND WARRANTY

The findings and recommendations contained herein assume the subsurface profile encountered in the exploratory boring and the groundwater level in the adjacent creek are representative of the overall site conditions at the proposed crossing. It is assumed the contractor, or their engineering consultants will design the shoring and dewatering system (if needed) and select the method of trenchless construction. Foundation Engineering has provided geotechnical parameters for use by the contractor and their design consultants. We should be provided the opportunity to review the final drawings prepared by the contractor's consultant to verify the appropriate parameters or assumptions have been used in the design. We also recommend being present during construction to confirm the assumed soil conditions during the excavation of the launching pit.

No changes in the enclosed recommendations should be made without our approval. We will assume no responsibility or liability for any engineering judgment, inspection, or testing performed by others.

This report was prepared for the exclusive use of Murraysmith and their design consultants for the NE Stephens Street & NE Hooker Road Crossing project in Roseburg, Oregon. Information contained herein should not be used for other sites or for unanticipated construction without our written consent. This report is intended for planning and design purposes. Contractors using this information to estimate construction quantities, costs, or means and methods do so at their own risk. Our services do not include any survey or assessment of potential surface contamination or contamination of the soil or groundwater by hazardous or toxic materials. We assume those services, if needed, have been completed by others.

Our work was done in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

Attachments

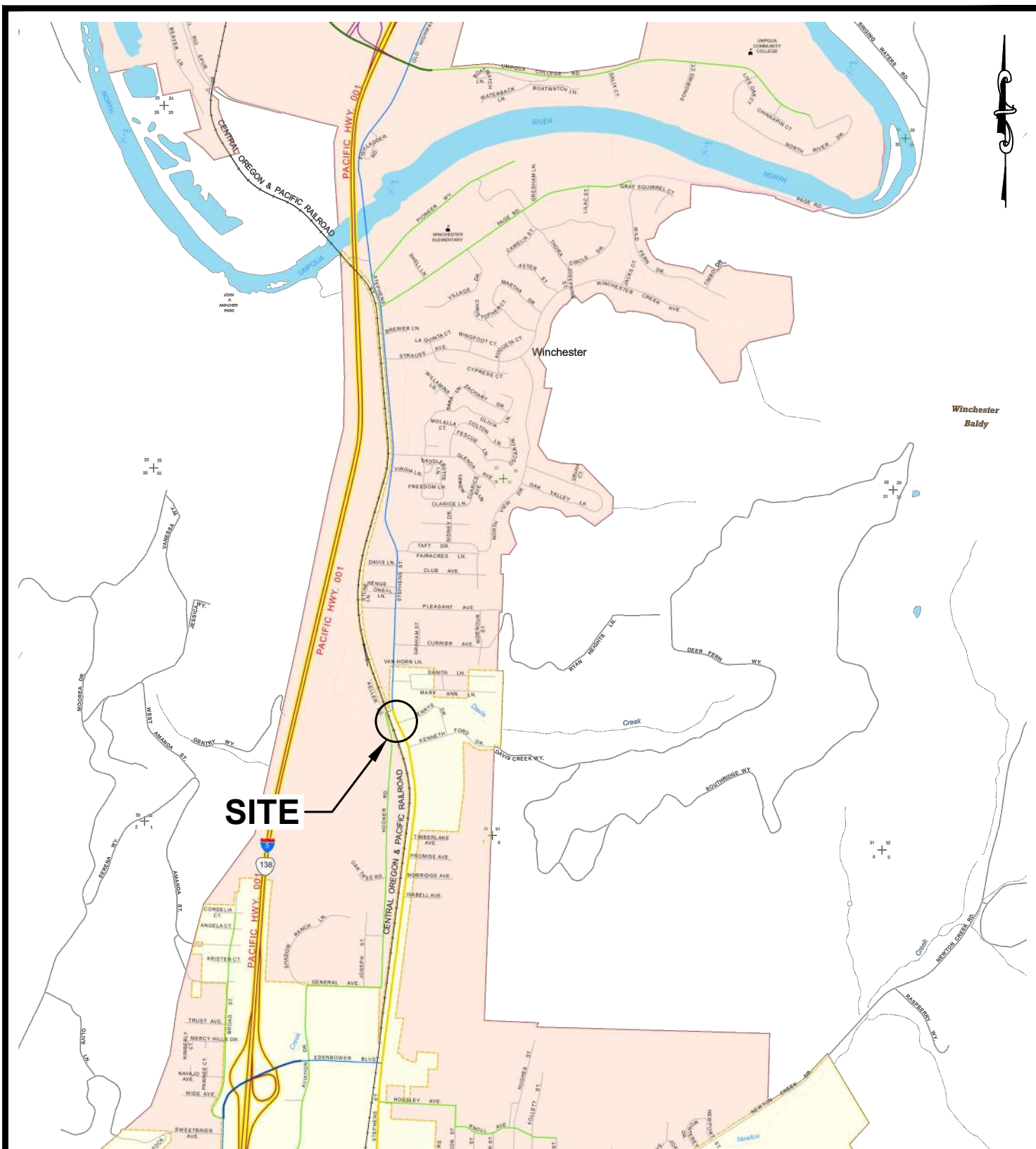
REFERENCES

- ASTM, 2009, *Standard Test Method for Description and Identification of Soils (Visual-Manual Procedure)*: American Society of Testing and Materials (ASTM) International, West Conshohocken, PA, ASTM Standard D 2488, DOI: 10.1520/D2488-09A, 11 p., www.astm.org.
- ASTM, 2011, *Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System, USCS)*: American Society of Testing and Materials (ASTM) International, West Conshohocken, PA, ASTM Standard D 2487, DOI: 10.1520/D2487-11, 11 p., www.astm.org.
- Murraysmith, 2021, *Transmission Main Plan and Profile, 24-inch Transmission Main, Hooker Road to Isabell Avenue, Roseburg, Oregon*: Murraysmith, Portland, Oregon, Sta 1+00 to Sta 6+40, May 2021, Sheet C-2.
- OR-OSHA, 2011, *Oregon Administrative Rules, Chapter 437, Division 3 - Construction, Subdivision P - Excavations*: Oregon Occupational Safety and Health Division (OR-OSHA), 1926.650, www.osha.oregon.gov.
- Peck, 1969, *Deep Excavation and Tunneling in Soft Ground*: Proceedings of the Seventh International Conference on Soil Mechanics and Foundation Engineering, Mexico City, 225-290 p.



Appendix A

Figures and Photos



NOTE:
 MAP OBTAINED FROM THE OREGON DEPARTMENT OF TRANSPORTATION WEBSITE
 (WWW.ODOT.GOV).



VICINITY MAP

FIGURE NO.

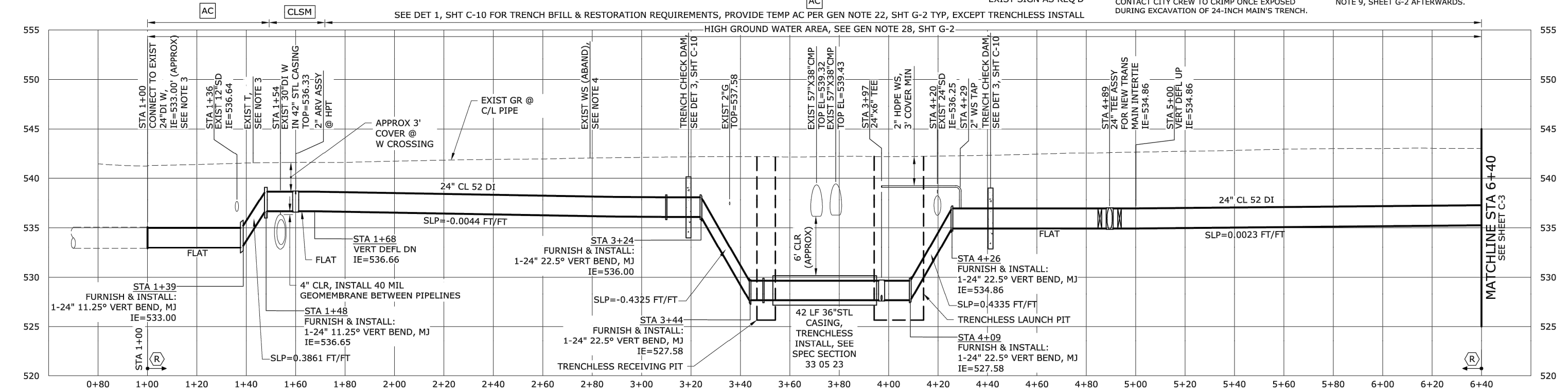
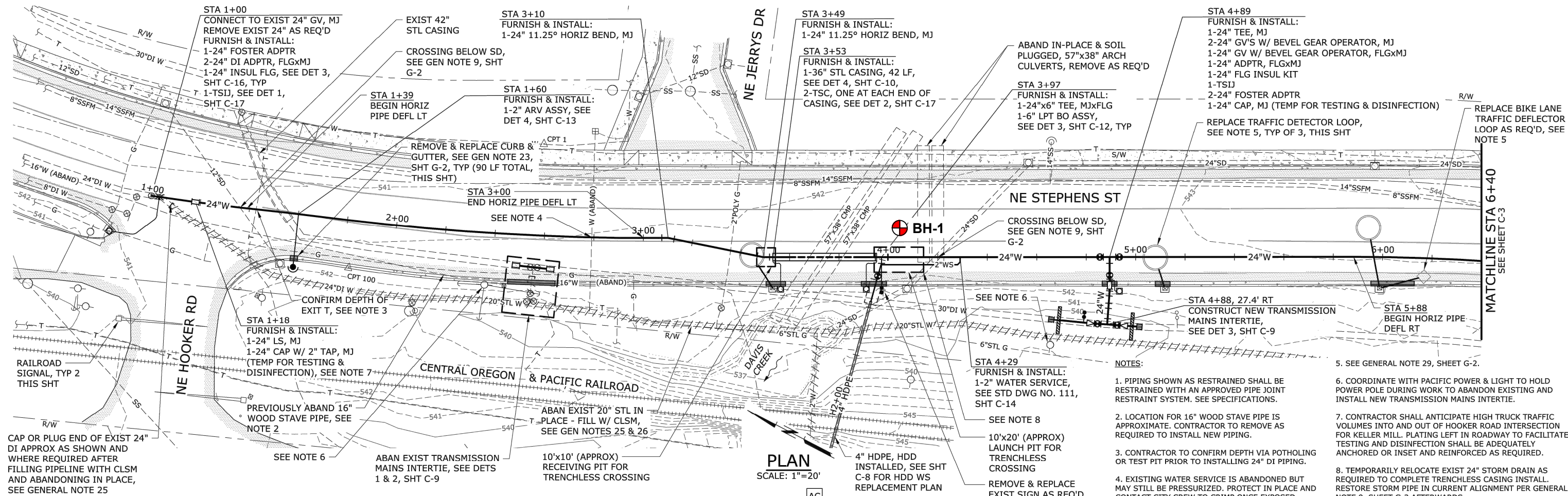
NE STEPHENS STREET & NE HOOKER ROAD CROSSING
 ROSEBURG, OREGON

1A

PROJECT NO.
 2211042

DATE:
 APR 2021

DRAWN BY:
 MLM



NOTES:

1. BORING LOCATION WAS ESTABLISHED BY MEASURING WHEEL REFERENCING EXISTING LANDMARKS AND IS APPROXIMATE ONLY.
2. SEE REPORT FOR A DISCUSSION OF SUBSURFACE CONDITIONS.
3. BASE MAP WAS PROVIDED BY MURRAYSMITH.



PROJECT NO.
2211042

DATE:
MAY 2021

DRAWN BY:
MLM

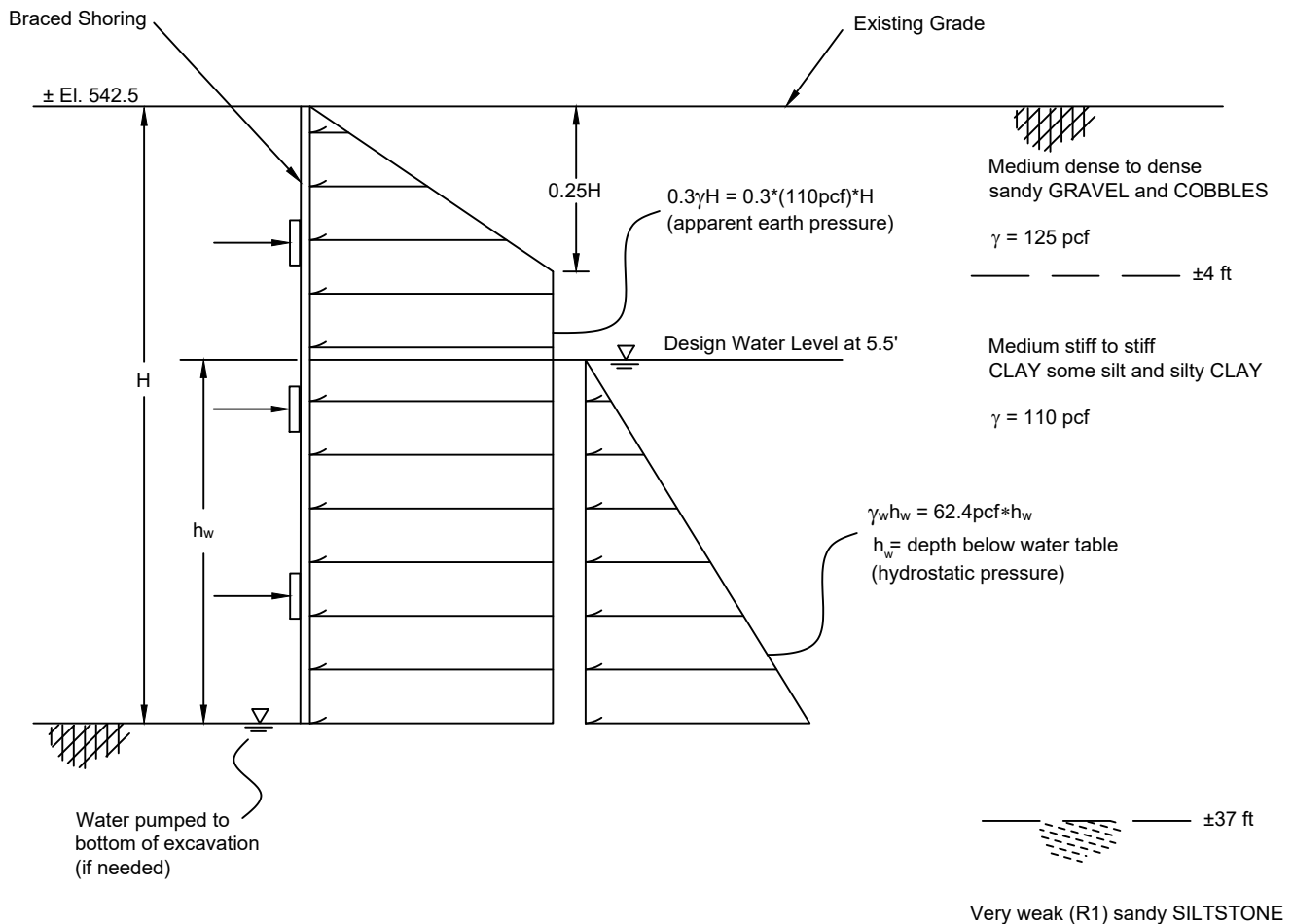
SITE LAYOUT AND BORING LOCATION

NE STEPHENS STREET & NE HOOKER ROAD CROSSING
ROSEBURG, OREGON

FIGURE NO.

2A

NOT TO SCALE



NOTES:

1. APPARENT EARTH PRESSURE DIAGRAM IS BASED ON RECOMMENDATIONS BY PECK (1969) FOR SOFT TO MEDIUM STIFF CLAY, MODIFIED TO ACCOUNT FOR GROUNDWATER. EQUIPMENT SURCHARGE PRESSURES SHOULD ALSO BE INCLUDED IN THE SHORING DESIGN.
2. ALL UNITS IN FEET, POUNDS, POUNDS PER SQUARE FOOT (PSF), AND POUNDS PER CUBIC FOOT (PCF).
3. THE SOIL PROFILE SHOWN IS GENERALIZED BASED ON THE AVERAGE SUBSURFACE CONDITIONS IN BH-1. THE DIMENSIONS SHOULD BE ADJUSTED BASED ON THE ACTUAL SHORING DEPTH AND SOIL PROFILE ENCOUNTERED.
4. DESIGN WATER LEVEL BASED ON THE LEVEL OF DAVIS CREEK AT THE TIME OF DRILLING. THE ACTUAL GROUNDWATER LEVEL SHOULD BE CONFIRMED AT THE TIME OF CONSTRUCTION.
5. SEE REPORT FOR ADDITIONAL COMMENTS REGARDING THIS FIGURE.



APPARENT EARTH PRESSURE DIAGRAM

FIGURE NO.

NE STEPHENS STREET & NE HOOKER ROAD CROSSING
ROSEBURG, OREGON

3A

PROJECT NO.
2211042

DATE:
APR 2021

DRAWN BY:
MLM



Photo 1. View of planned crossing, looking west along Davis Creek.



Photo 2. Existing CMP culverts.



Appendix B

Boring Log

DISTINCTION BETWEEN FIELD LOGS AND FINAL LOGS

A field log is prepared for each boring or test pit by our field representative. The log contains information concerning sampling depths and the presence of various materials such as gravel, cobbles, and fill, and observations of ground water. It also contains our interpretation of the soil conditions between samples. The final logs presented in this report represent our interpretation of the contents of the field logs and the results of the sample examinations and laboratory test results. Our recommendations are based on the contents of the final logs and the information contained therein and not on the field logs.

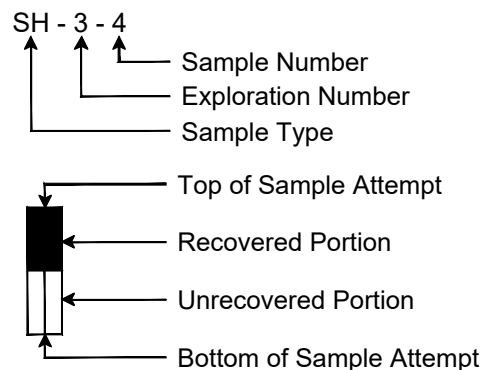
VARIATION IN SOILS BETWEEN TEST PITS AND BORINGS

The final log and related information depict subsurface conditions only at the specific location and on the date indicated. Those using the information contained herein should be aware that soil conditions at other locations or on other dates may differ. Actual foundation or subgrade conditions should be confirmed by us during construction.

TRANSITION BETWEEN SOIL OR ROCK TYPES

The lines designating the interface between soil, fill or rock on the final logs and on subsurface profiles presented in the report are determined by interpolation and are therefore approximate. The transition between the materials may be abrupt or gradual. Only at boring or test pit locations should profiles be considered as reasonably accurate and then only to the degree implied by the notes thereon.

SAMPLE OR TEST SYMBOLS



- C - Pavement Core Sample
- CS - Rock Core Sample
- OS - Oversize Sample (3-inch O.D. split-spoon)
- S - Grab Sample
- SH - Thin-walled Shelby Tube Sample
- SS - Standard Penetration Test Sample (2-inch O.D. split-spoon)

▲ Standard Penetration Test Resistance equals the number of blows a 140 lb. weight falling 30 in. is required to drive a standard split-spoon sampler 1 ft. Practical refusal is equal to 50 or more blows per 6 in. of sampler penetration.

● Water Content (%)

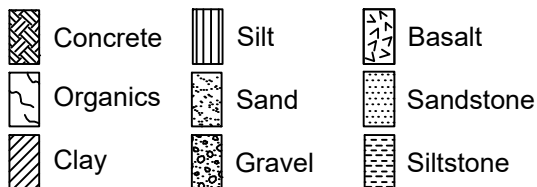
FIELD SHEAR STRENGTH TEST

Shear strength measurements on test pit side walls, blocks of soil or Shelby tube samples are typically made with Torvane or Field Vane shear devices.

WATER TABLE

▼ Water Table Location
(1/31/16) Date of Measurement

TYPICAL SOIL/ROCK SYMBOLS



UNIFIED SOIL CLASSIFICATION SYMBOLS

G - Gravel	W - Well Graded
S - Sand	P - Poorly Graded
M - Silt	L - Low Plasticity
C - Clay	H - High Plasticity
Pt - Peat	O - Organic

Explanation of Common Terms Used in Soil Descriptions

Field Identification	Cohesive Soils			Granular Soils	
	SPT*	S _u ** (tsf)	Term	SPT*	Term
Easily penetrated several inches by fist.	0 - 2	< 0.125	Very Soft	0 - 4	Very Loose
Easily penetrated several inches by thumb.	2 - 4	0.125 - 0.25	Soft	4 - 10	Loose
Can be penetrated several inches by thumb with moderate effort.	4 - 8	0.25 - 0.50	Medium Stiff	10 - 30	Medium Dense
Readily indented by thumb but penetrated only with great effort.	8 - 15	0.50 - 1.0	Stiff	30 - 50	Dense
Readily indented by thumbnail.	15 - 30	1.0 - 2.0	Very Stiff	> 50	Very Dense
Indented with difficulty by thumbnail.	> 30	> 2.0	Hard		

* SPT N-value in blows per foot (bpf)

** Undrained shear strength

Term	Soil Moisture Field Description
Dry	Absence of moisture. Dusty. Dry to the touch.
Damp	Soil has moisture. Cohesive soils are below plastic limit and usually moldable.
Moist	Grains appear darkened, but no visible water. Silt/clay will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grain surfaces. Sand and cohesionless silt exhibit dilatancy. Cohesive soil can be readily remolded. Soil leaves wetness on the hand when squeezed. Soil is wetter than the optimum moisture content and above the plastic limit.

Term	PI	Plasticity Field Test
Non-plastic	0 - 3	Cannot be rolled into a thread at any moisture.
Low Plasticity	3 - 15	Can be rolled into a thread with some difficulty.
Medium Plasticity	15 - 30	Easily rolled into thread.
High Plasticity	> 30	Easily rolled and re-rolled into thread.

Term	Soil Structure Criteria
Stratified	Alternating layers at least ¼ inch thick.
Laminated	Alternating layers less than ¼ inch thick.
Fissured	Contains shears and partings along planes of weakness.
Slickensided	Partings appear glossy or striated.
Blocky	Breaks into small lumps that resist further breakdown.
Lensed	Contains pockets of different soils.

Term	Soil Cementation Criteria
Weak	Breaks under light finger pressure.
Moderate	Breaks under hard finger pressure.
Strong	Will not break with finger pressure.



Foundation Engineering, Inc.
Professional Geotechnical Services

SOIL DESCRIPTIONS

COMMON TERMS

Explanation of Common Terms Used in Rock Descriptions

Field Identification		UCS (psi)	Strength	Hardness (ODOT)
Indented by thumbnail.	R0	< 100	Extremely Weak	Extremely Soft
Crumbles under firm blows with geological hammer. Can be peeled by a pocket knife.	R1	100 - 1,000	Very Weak	Very Soft
Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with geological hammer.	R2	1,000 - 4,000	Weak	Soft
Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single blow of geological hammer.	R3	4,000 - 8,000	Medium Strong	Medium Hard
Specimen requires more than one blow of geological hammer to fracture it.	R4	8,000 - 16,000	Strong	Hard
Specimen requires many blows of geological hammer to fracture it.	R5	> 16,000	Very Strong	Very Hard

Term (ODOT)	Weathering Field Identification
Fresh	Crystals are bright. Discontinuities may show some minor surface staining. No discoloration in rock fabric.
Slightly Weathered	Rock mass is generally fresh. Discontinuities are stained and may contain clay. Some discoloration in rock fabric.
Moderately Weathered	Significant portions of rock show discoloration and weathering effects. Crystals are dull and show visible chemical alteration. Discontinuities are stained and may contain secondary mineral deposits.
Highly Weathered (Predominately Decomposed)	Rock can be excavated with geologist's pick. All discontinuities exhibit secondary mineralization. Complete discoloration of rock fabric. Surface of core is friable and usually pitted due to washing out of highly altered minerals by drilling water.
Decomposed	Rock mass is completely decomposed. Original rock "fabric" may be evident (relict texture). May be reduced to soil with hand pressure.

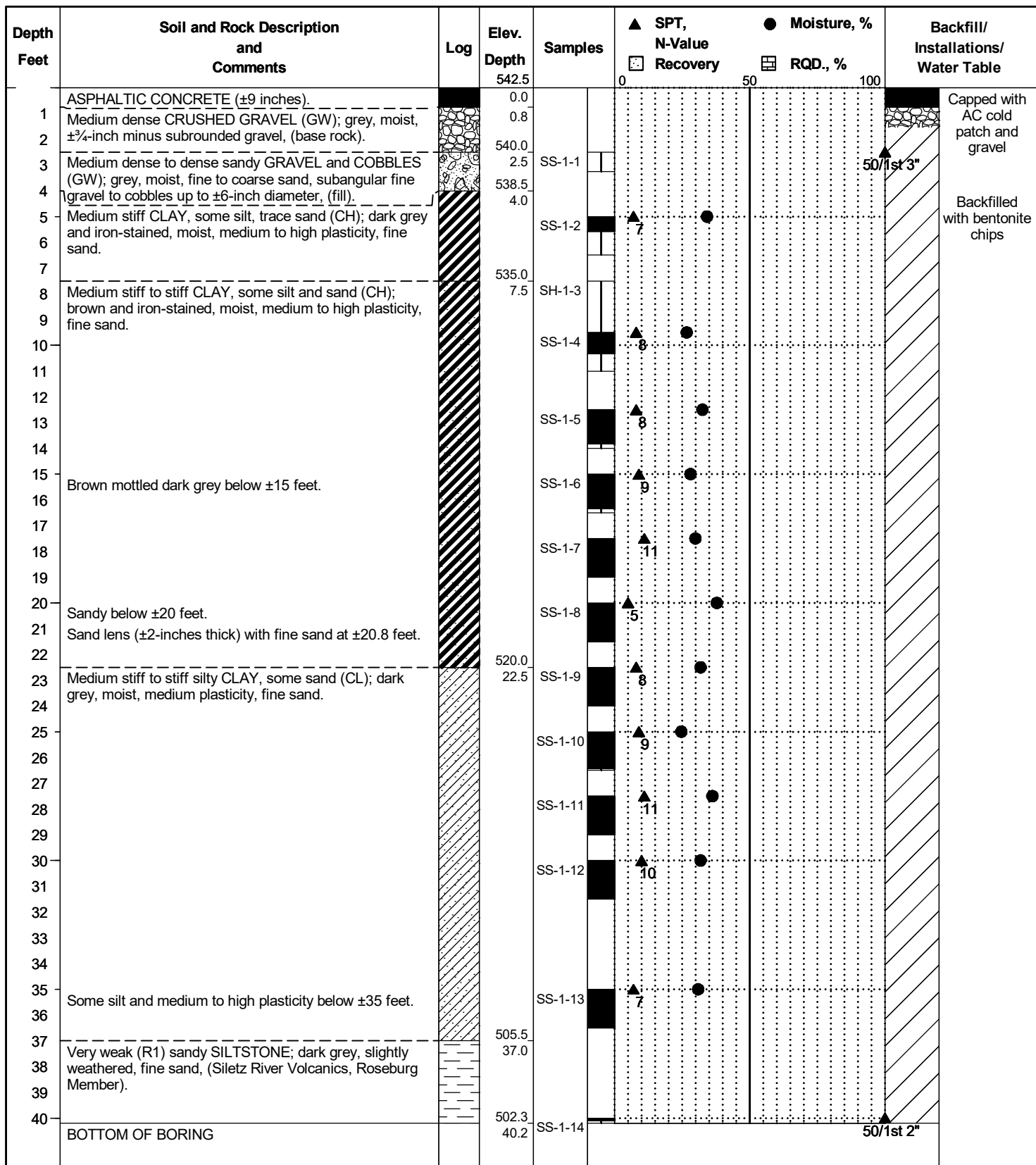
Spacing (metric)	Spacing (imperial)	Spacing Term	Bedding/Foliation
< 6 cm	< 2 in.	Very Close	Very Thin (Laminated)
6 cm - 30 cm	2 in. - 1 ft.	Close	Thin
30 cm - 90 cm	1 ft. - 3 ft.	Moderately Close	Medium
90 cm - 3.0 m	3 ft - 10 ft.	Wide	Thick
> 3.0 m	> 10 ft.	Very Wide	Very Thick (Massive)

Vesicle Term	Volume
Some vesicles	5 - 25%
Highly vesicular	25 - 50%
Scoriaceous	> 50%

Stratification Term	Description
Lamination	< 1 cm (0.4 in.) thick beds
Fissile	Preferred break along laminations
Parting	Preferred break parallel to bedding
Foliation	Metamorphic layering and segregation of minerals

RQD %	Designation	RQD %	Designation
0 - 25	Very Poor	75 - 90	Good
25 - 50	Poor	90 - 100	Excellent
50 - 75	Fair		

Rock Quality Designation (RQD) is the cumulative length of intact rock core pieces 4 inches or longer excluding breaks caused by drilling and handling divided by run length, expressed as a percentage.



Project No.: 2211042

Surface Elevation: 542.5 feet (Approx.)

Date of Boring: April 16, 2021

Boring Log: BH-1

NE Stephens Street & NE Hooker Road Crossing

Roseburg, Oregon



Foundation Engineering, Inc.



Appendix C

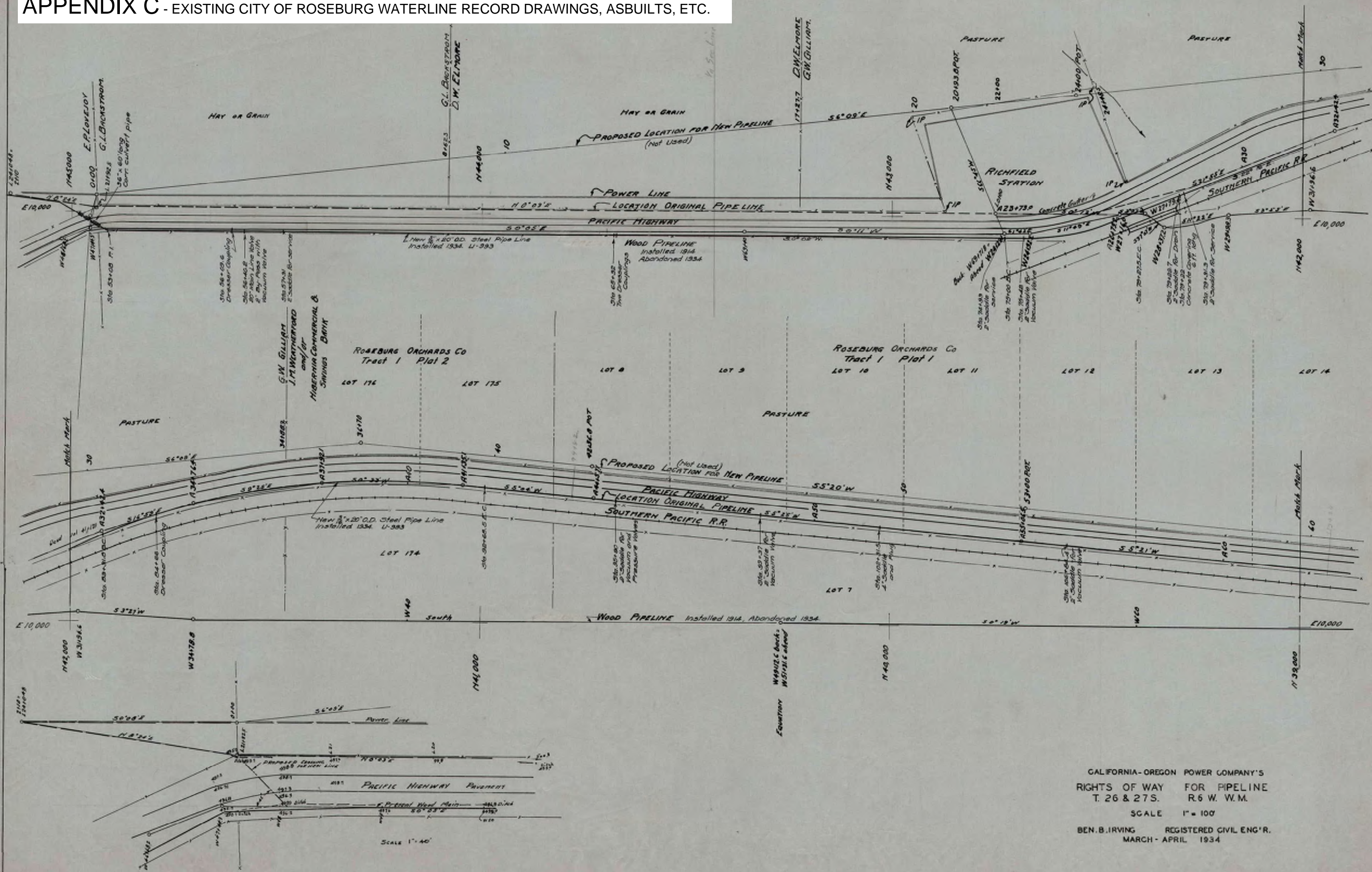
Laboratory Testing

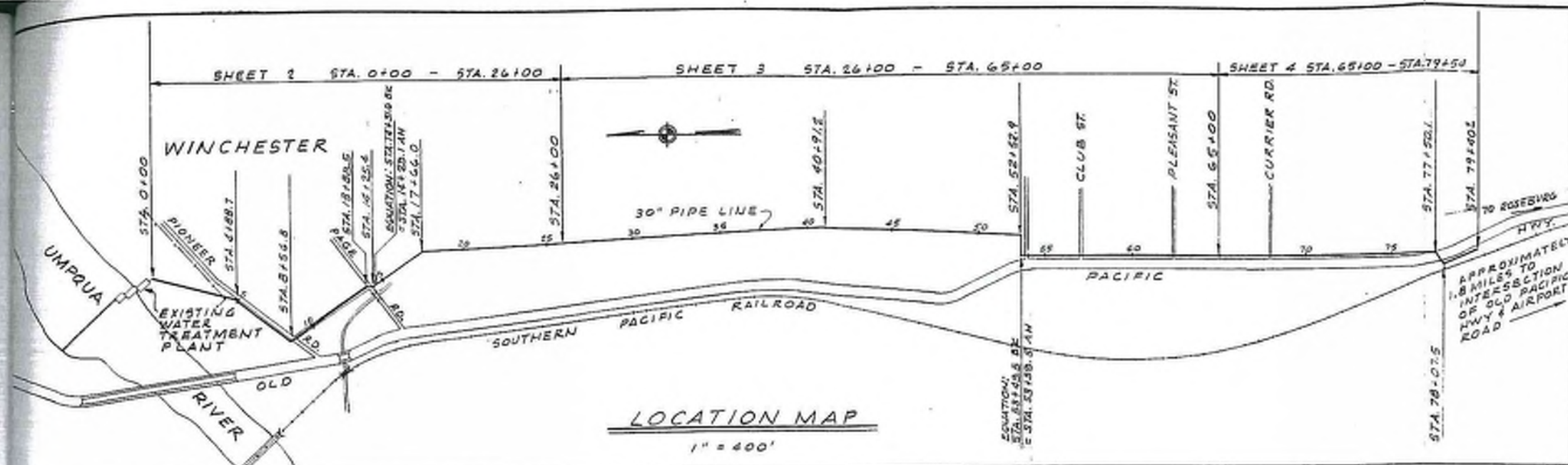
Foundation Engineering, Inc.
 NE Stephens Street & NE Hooker Road Crossing
 Project No.: 2211042

**Table 1C. Moisture Contents (ASTM D 2216), Percent Fines (ASTM D 1140),
 and Atterberg Limits (ASTM D 4318)**

Sample Number	Sample Depth (ft)	Moisture Content (%)	Fines (%)	Atterberg Limits			USCS Classification
				LL	PL	PI	
SS-1-2	5.0 - 7.5	34.2					
SS-1-4	9.5 - 11.0	26.7					
SS-1-5	12.5 - 14.0	32.5		56	25	31	CH
SS-1-6	15.0 - 16.5	28.1					
SS-1-7	17.5 - 19.0	29.9					
SS-1-8	20.0 - 21.5	37.8	80.3				
SS-1-9	22.5 - 24.0	31.8		48	27	21	CL
SS-1-10	25.0 - 26.5	24.7					
SS-1-11	27.5 - 29.0	36.2					
SS-1-12	30.0 - 31.5	31.8					
SS-1-13	35.0 - 36.5	30.9		55	28	27	CH

APPENDIX C - EXISTING CITY OF ROSEBURG WATERLINE RECORD DRAWINGS, ASBUILTS, ETC.





INDEX TO DRAWINGS	
SHEET NO.	TITLE
1	LOCATION MAP AND INDEX TO DRAWINGS.
2	PLAN AND PROFILE STATION 0+00 TO STATION 26+00.
3	PLAN AND PROFILE STATION 26+00 TO STATION 65+00.
4	PLAN AND PROFILE STATION 65+00 TO STATION 79+50 AND DETAILS.
5	DETAILS.
6	DETAILS.

LEGEND FOR PLAN AND PROFILE

- PROPOSED 30" WATER LINE.
- 20" — EXISTING WATER LINES (SIZE INDICATED).
- ⊕ FIRE HYDRANT.
- ⊗ WATER METERS.
- ⊕ VALVES.
- ⊕ POWER POLES.
- ⊕ CATCH BASINS.
- ⊕ SIGNS.
- X — X — FENCES.
- — — — — PROPERTY AND RIGHT OF WAY LINES.
- ⊕ 216 FT. CLASS OF BACKFILL (LENGTH INDICATED).

LOCATION OF FITTINGS AND EQUIPMENT

BUTTERFLY VALVES			STATION	STATION	STATION	STATION
STATION	16"	20"				
0+04		X	14+35	11+75	13+95	18+40
52+12		X	56+84	75+70	54+00	18+45
79+11		X	62+35			
79+17		X	67+85			
79+14	X		72+58			
79+14	X					
79+14	X					

THIS PRINT IS REDUCED TO ONE-HALF
OF THE ORIGINAL SCALE
IF THE SCALE READS
1" = 1'-0" USE 1/2" = 1'-0" OR 1" = 18" USE 1" = 20"



CORNELL,
HOWLAND,
HAYES &
MERRYFIELD
ENGINEERS
& PLANNERS
PORTLAND OREGON

OREGON WATER CORPORATION ROSEBURG, OREGON
30 - INCH WATER TRANSMISSION PIPELINE
LOCATION MAP
AND
INDEX TO DRAWINGS

DESIGNED BY
DRAWN BY
CHECKED BY
DATE
1955
AS SHOWN
C 3577-1

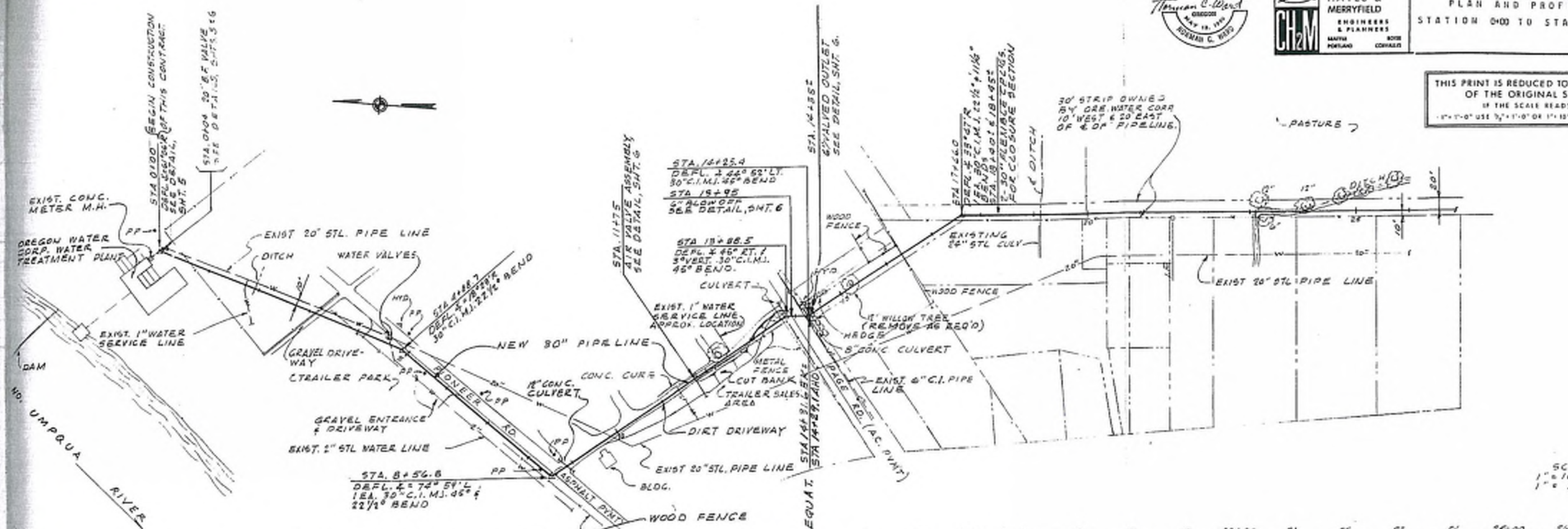


CORNELL,
HOWLAND,
HAYES &
MERRYFIELD
ENGINEERS
& PLANNERS
PORTLAND
CORVALLIS

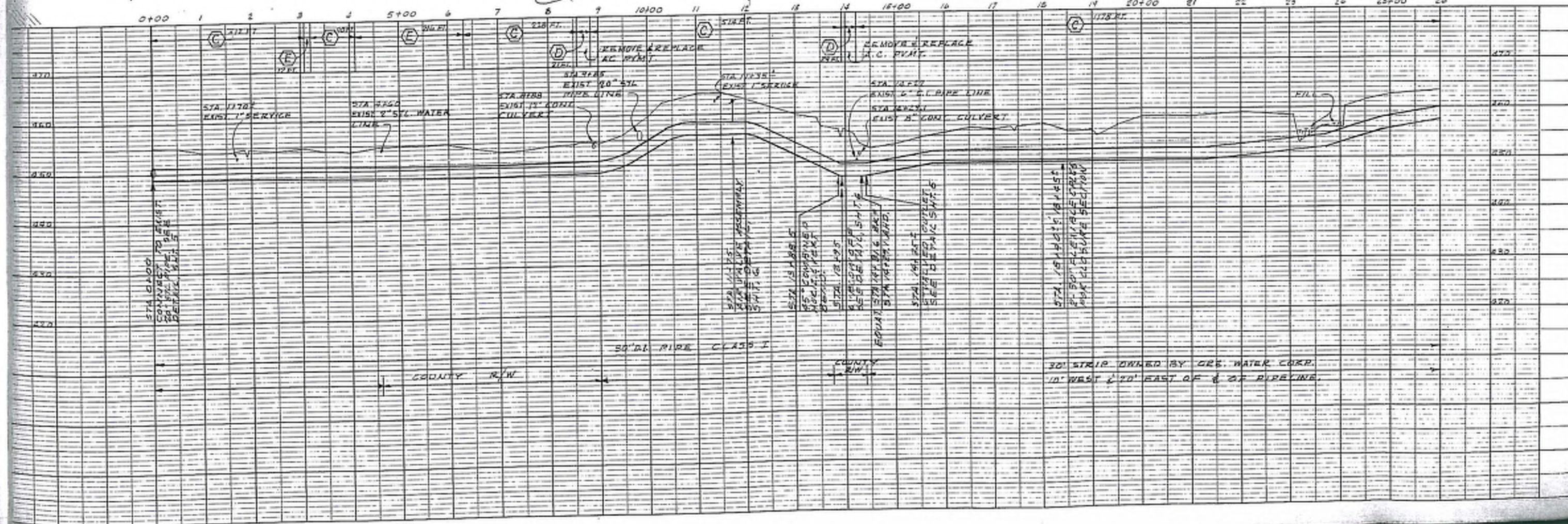
OREGON WATER CORPORATION, CORVALLIS, OREGON
30" INCH WATER TRANSMISSION PIPELINE
PLAN AND PROFILE
STATION 0+00 TO STATION 26+00

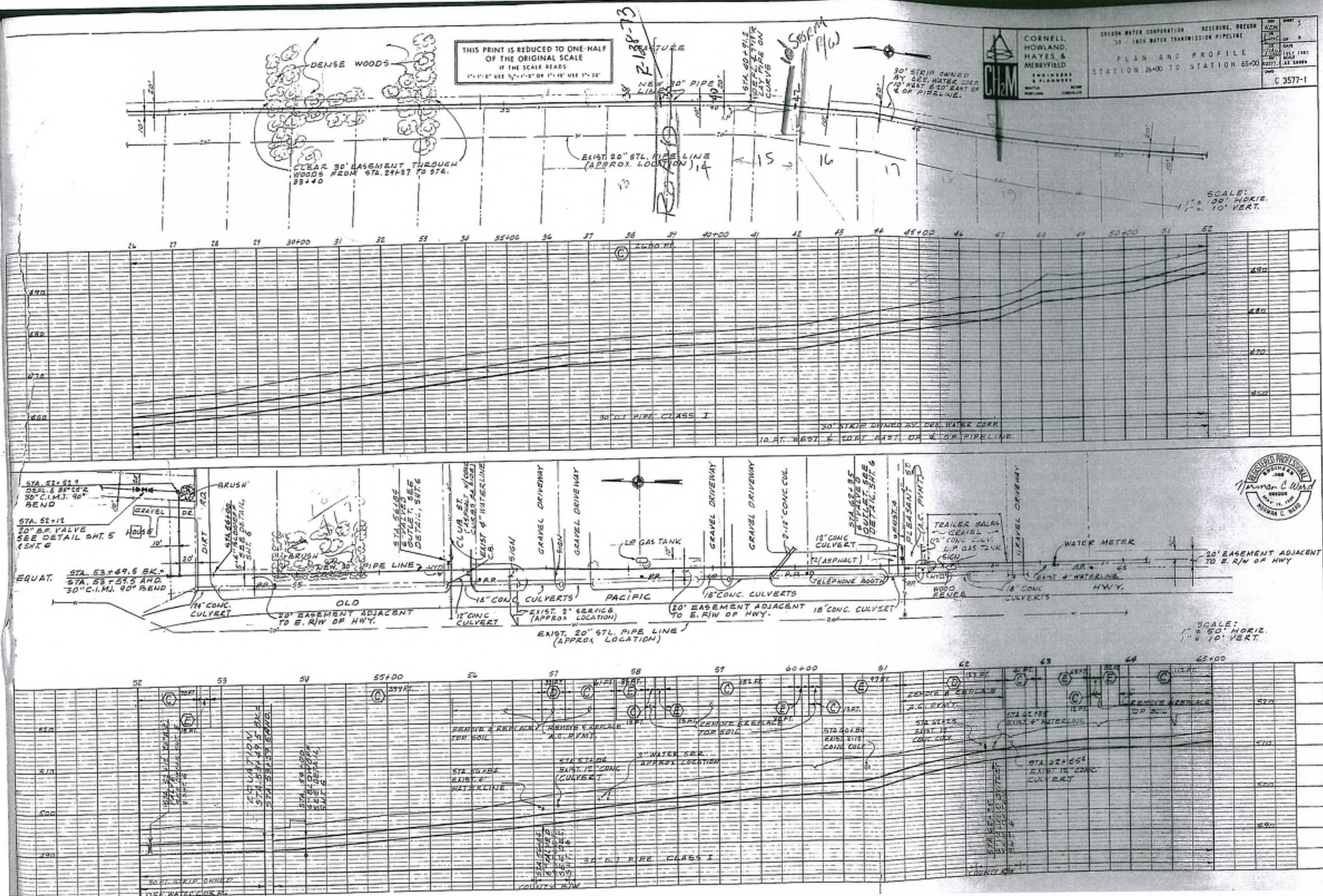
DATE: JULY 1960
BY: R.C.W.
CHECKED: J.S.M.
3577-1

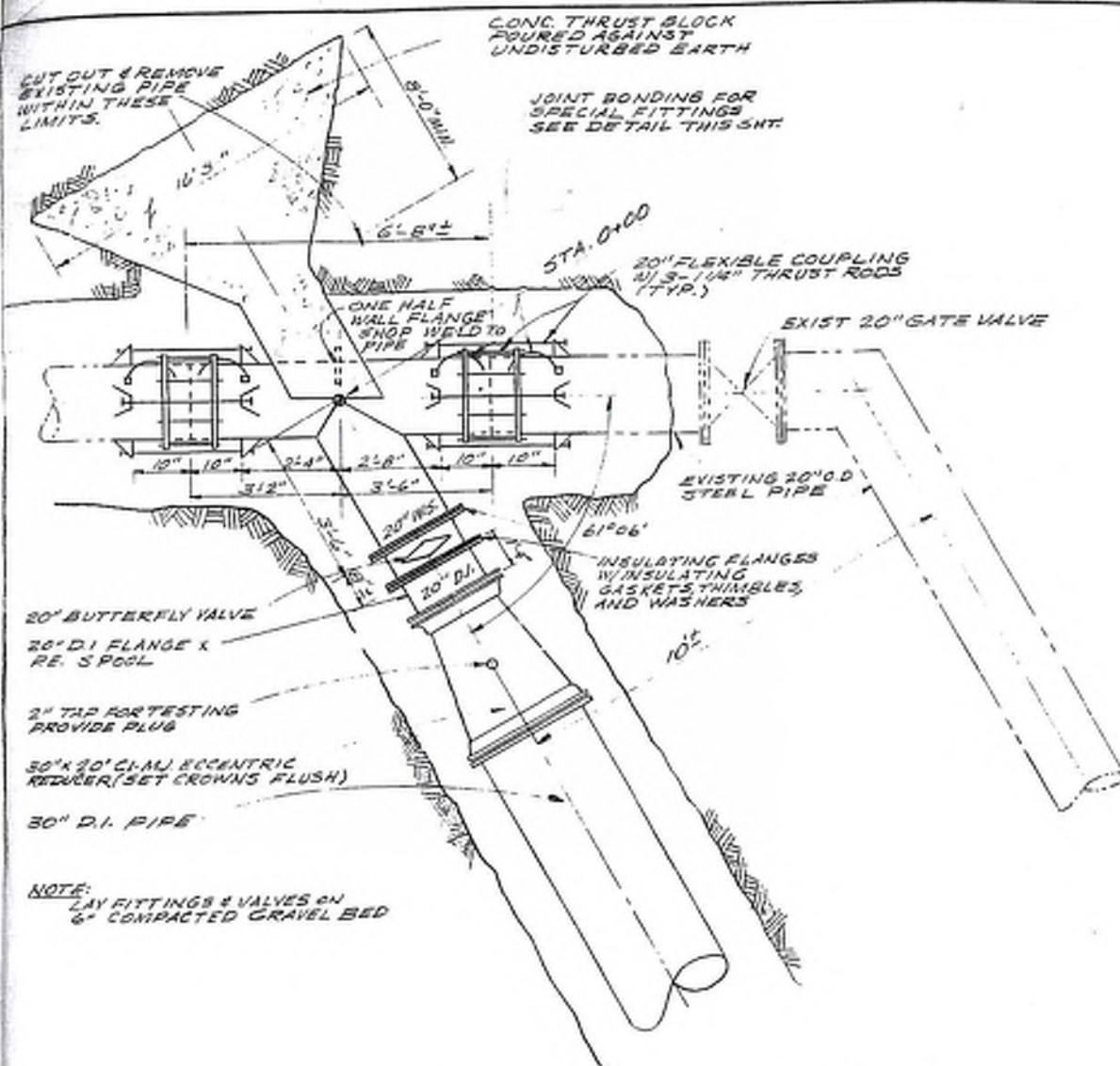
THIS PRINT IS REDUCED TO ONE-HALF
OF THE ORIGINAL SCALE
IF THE SCALE READS:
1" = 1'-0" USE 1/2" = 1'-0" OR 1" = 10' USE 1" = 30'



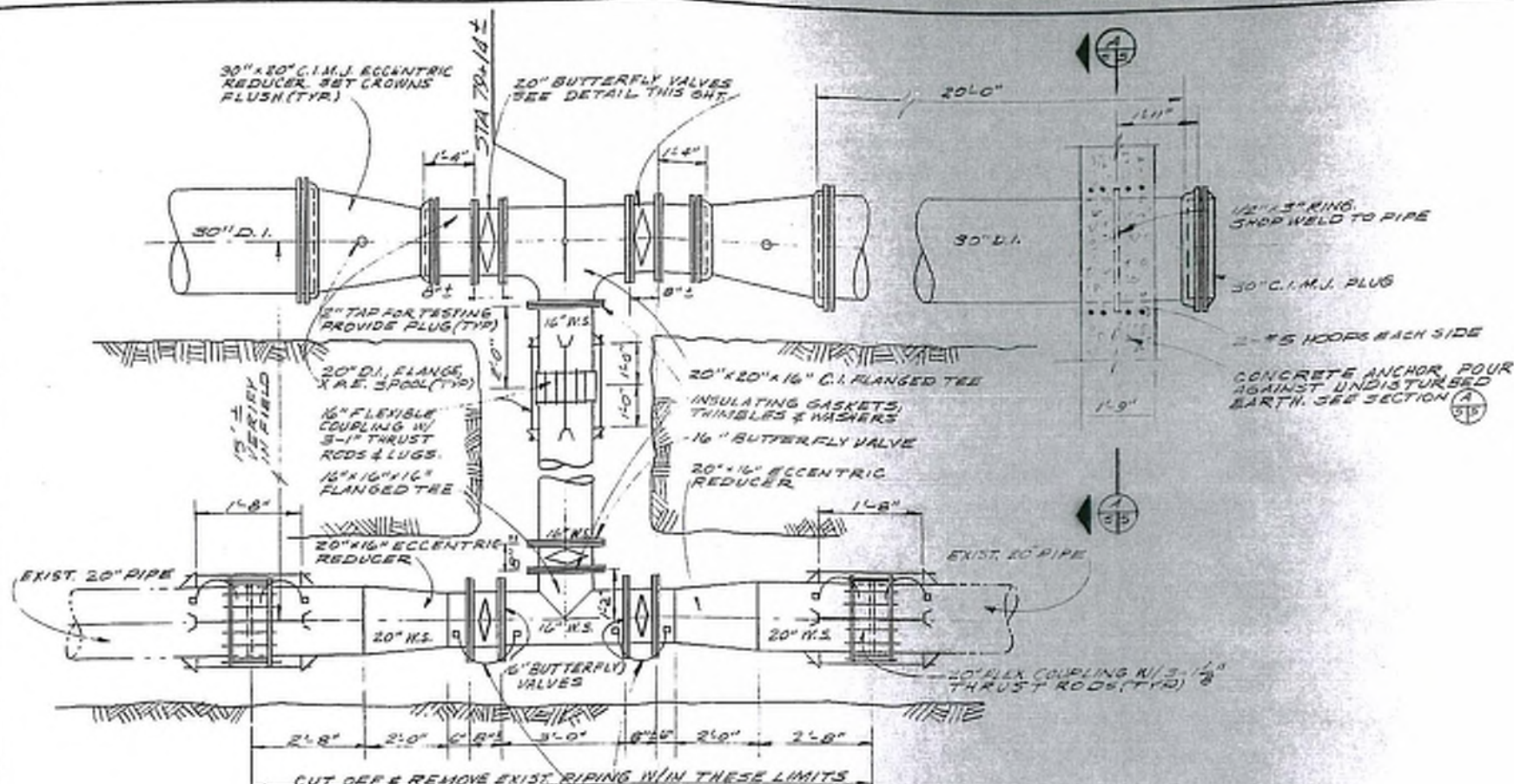
SCALE:
1" = 100' HORIZ.
1" = 10' VERT.



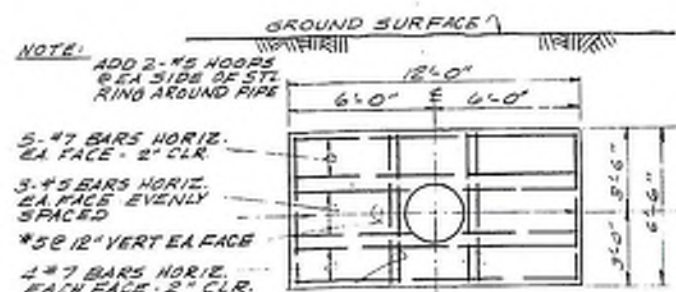




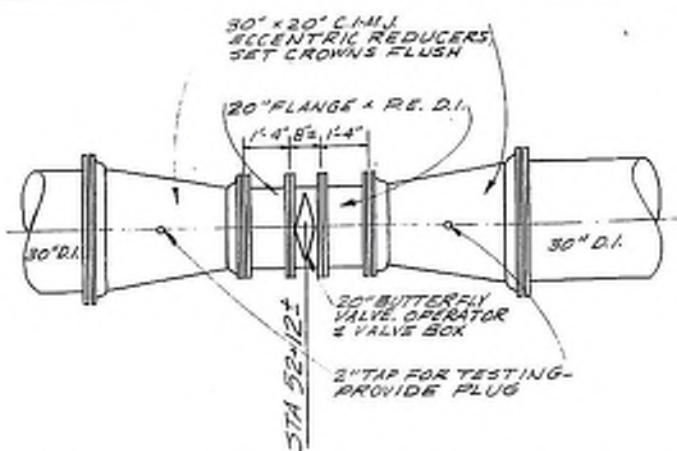
PLAN OF PIPING-DETAIL AT STA. 0+00
1/2" = 1'-0"



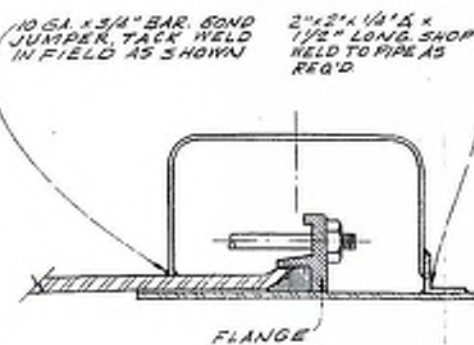
PLAN OF PIPING-DETAIL @ STA 79+14 ±
1/2" = 1'-0"



SECTION
1/4" = 1'-0"



LINE VALVE PIPING DETAIL @ STA 52+12 ±
1/2" = 1'-0"



JOINT BONDING DETAIL
FOR SPECIAL FITTINGS
NO SCALE.

- NOTES:
1. REMOVE PROTECTIVE COATING AS REQUIRED AND WIRE BRUSH STEEL AS NECESSARY TO PROVIDE SOUND ELECTRICAL CONTINUITY AT WELDS.
 2. COAT ASSEMBLED JOINT BOND WITH COAL TAR ENAMEL.



CORNELL, HOWLAND, HAYES & MERRYFIELD
ENGINEERS & PLANNERS
PORTLAND OREGON

THIS PRINT IS REDUCED TO ONE-HALF OF THE ORIGINAL SCALE IF THE SCALE READS:
1" = 1'-0" USE 1/2" = 1'-0" OR 1" = 1'-0" USE 1" = 1'-0"

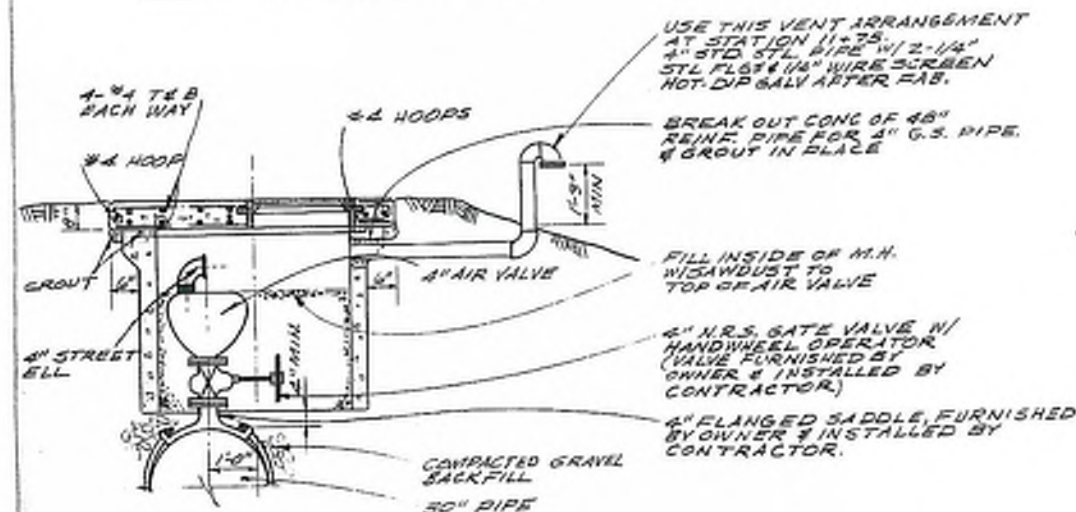
OREGON WATER CORPORATION ROSEBURG, OREGON
30 - INCH WATER TRANSMISSION PIPELINE

DETAILS

DESIGNED BY	DATE
CHECKED BY	DATE
APPROVED BY	DATE
DATE	3577-1



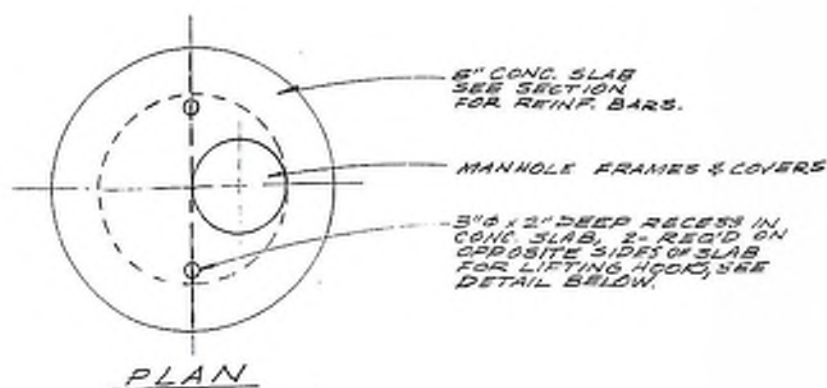
VENT @ STA 76+00



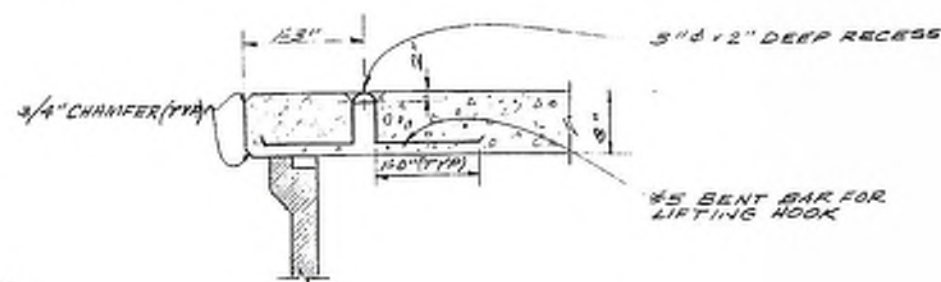
4" AIR VALVE

AIR VALVE ASSEMBLY & DETAILS

NOT TO SCALE

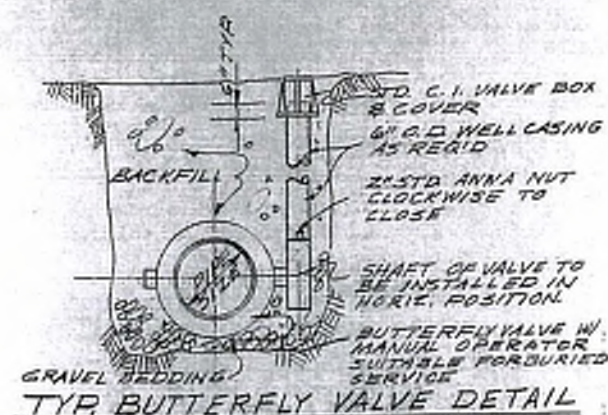


PLAN



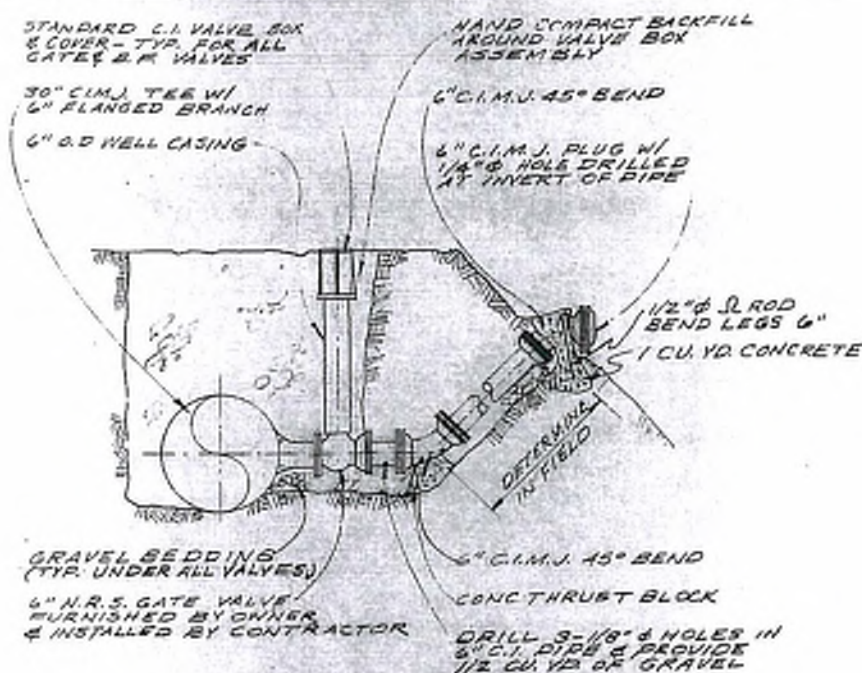
SLAB LIFTING HOOK

N.T.S.



TYP. BUTTERFLY VALVE DETAIL

N.T.S.

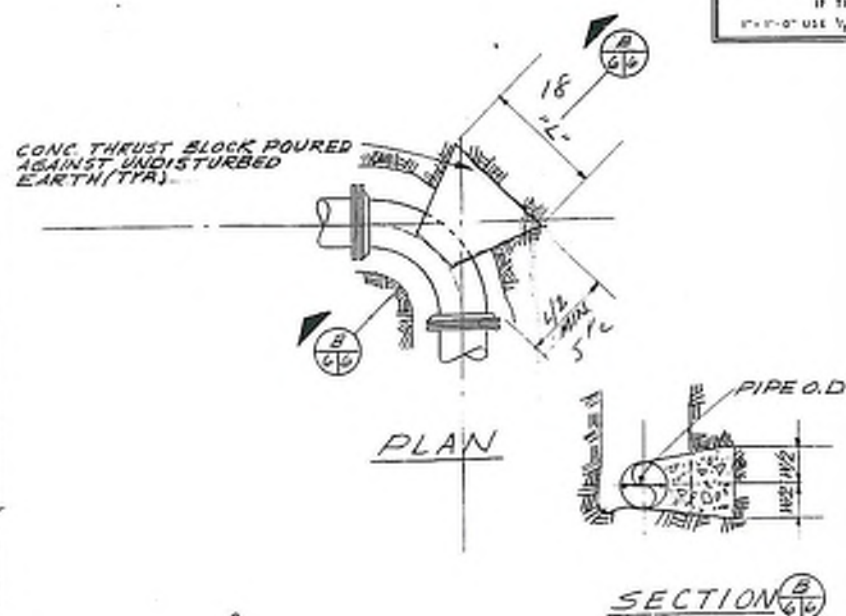


TYPICAL BLOWOFF DETAIL

1/2" - 1" O.D.
2" REQ'D.

THRUST BLOCK TABLE				
STA	DEGREE OF BEND	DIMENSIONS OF THRST BLK.		REQ'D AREA
		L	W	FT. 2
0+00	SEE DTL. SHT.	16'-3"	5'-0"	81
4+88.7	22 1/2°	6'-6"	5'-0"	32
8+56.8	22 1/2°	6'-6"	5'-0"	32
8+56.8	45°	12'-6"	5'-0"	62
13+88.5	45°	12'-6"	5'-0"	62
14+25.4	45°	12'-6"	5'-0"	62
17+66.0	11 1/4°	4'-0"	4'-0"	16
17+66.0	22 1/2°	6'-6"	5'-0"	32
52+52.9	90°	18'-6"	5'-6"	101
53+42.5	90°	18'-6"	5'-6"	101
77+50.1	45°	9'-3"	5'-0"	48
78+07.9	22 1/2°	5'-0"	5'-0"	25
78+07.5	45°	9'-3"	5'-0"	48

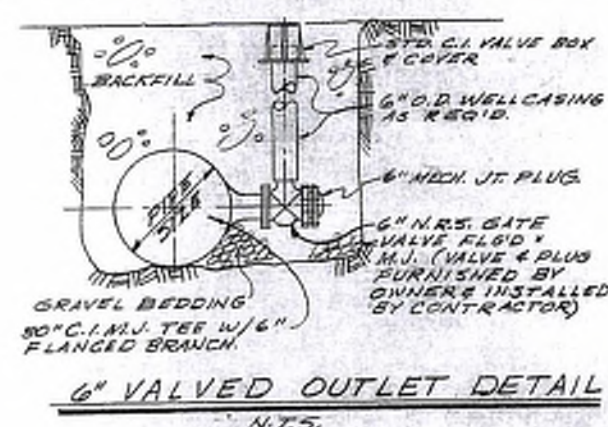
NOTE:
THRUST BLOCKS SHALL CLEAR ALL BOLTS.



TYPICAL THRUST BLOCK DETAILS

NOT TO SCALE

THIS PRINT IS REDUCED TO ONE-HALF OF THE ORIGINAL SCALE IF THE SCALE READS:
1" = 1'-0" USE 1/2" = 1'-0" OR 1" = 1'-0" USE 1" = 2'-0"



6" VALVED OUTLET DETAIL

N.T.S.



OREGON WATER CORPORATION ROSSBURG, OREGON
30 - INCH WATER TRANSMISSION PIPELINE

DETAILS

DATE	6
BY	H.B.
CHECKED	6
DATE	JULY 1985
SCALE	AS SHOWN
NO.	C 3577-1

30" TRANSMISSION WATER LINE

PROJECT 81-05(c)

LEGEND

GAS LINE
STREETS & R.R. C.
R/W
P/L
POWER POLE
RED FLASHER
BLOCK SIGNALS
PROP. PIN.
FENCE WITH GATE
GUY POLE
CULVERT
HUB & TACK
R.R. TELEPHONE POLE
EDGE PAVEMENT
BURIED TELEPHONE LINE
BURIED POWER LINE
FIRE HYDRANT
WATER VALVE
MAIL BOX
HWY. MARKER
TELEPHONE BOX
EDGE GRAVEL SHOULDER
WATER METER
DITCH
17 POUND MAGNESIUM ANODE
LOCATION (APPROX.)
TEST STATION (TYPE T, UNLESS
OTHERWISE NOTED)
IN LINE INSULATOR LOCATION

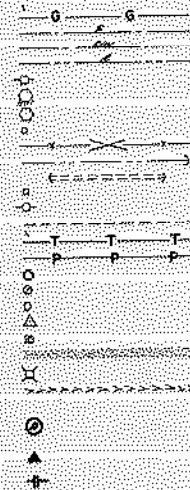
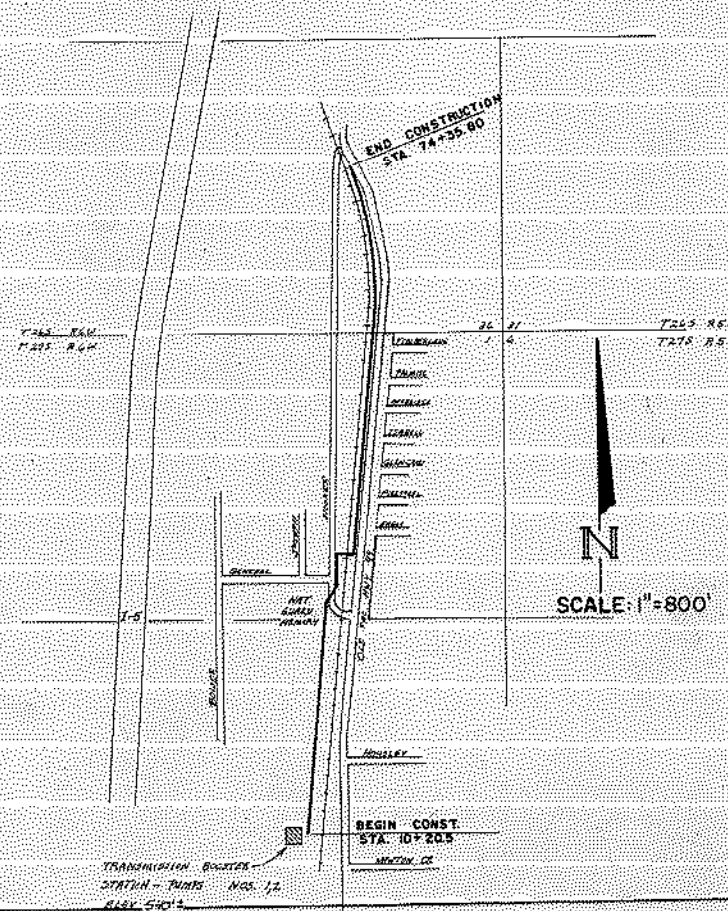


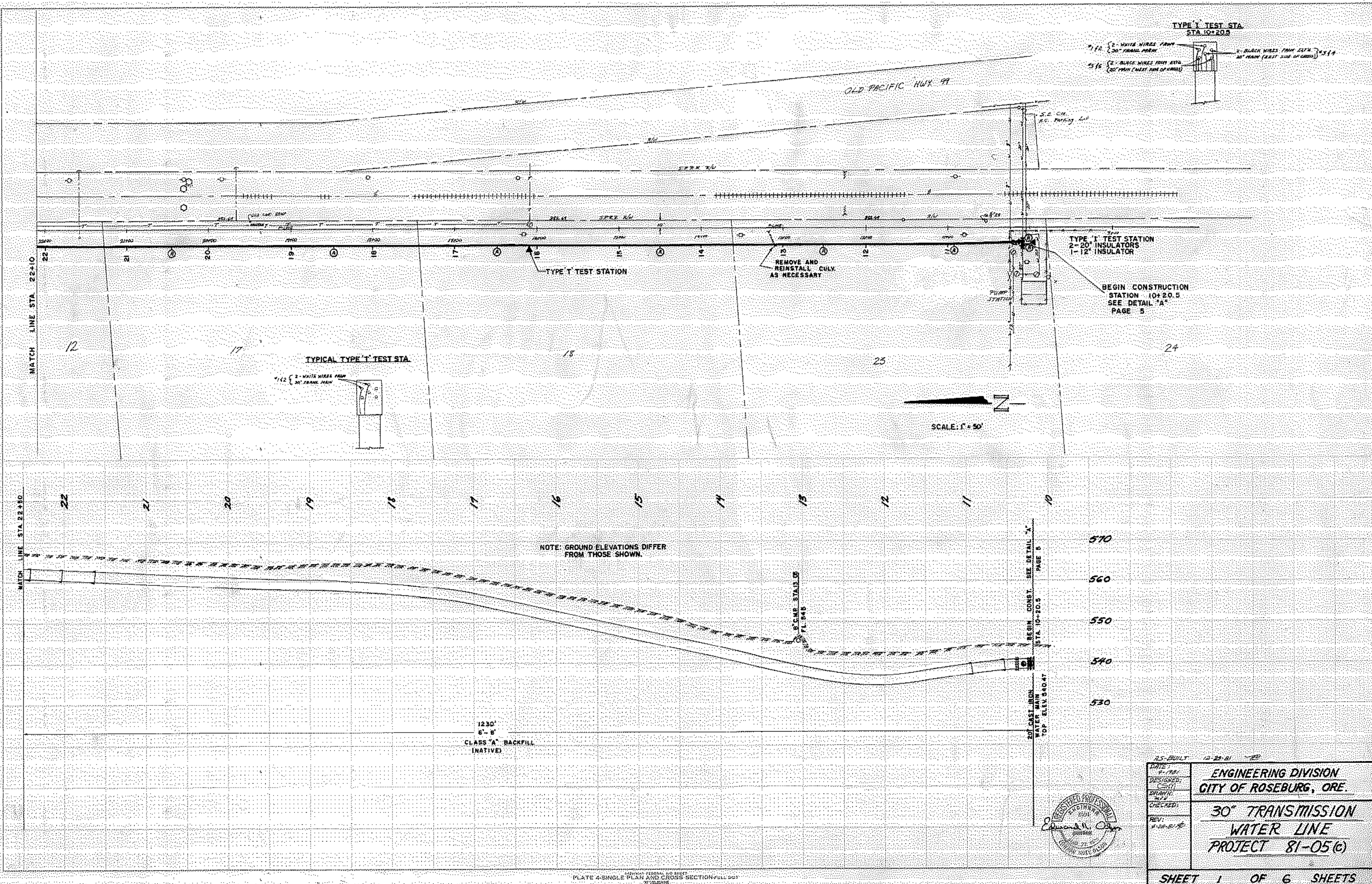
TABLE OF CONTENTS

"L" STA. 10+20.5 — 22+10	PAGE 1
" 22+10 — 39+13	" 2
" 39+13 — 54+58	" 3
" 54+58 — 68+98	" 4
" 68+98 — 74+35.80	" 5
DETAILS	" 5
"	" 6

VICINITY MAP OF PROJECT



DESIGNED BY CHECKED BY APPROVED BY DATE BY	REvised 12-27-81 ENGINEERING DIVISION CITY OF ROSEBURG, ORE. 30" TRANSMISSION WATER LINE PROJECT 81-05(c) TITLE SHEET
--	---



FINAL	DATE	BY
SURVEY		
DESIGN		
CHECK		

ORIGINAL	DATE	BY
SURVEY		
DESIGN		
CHECK		

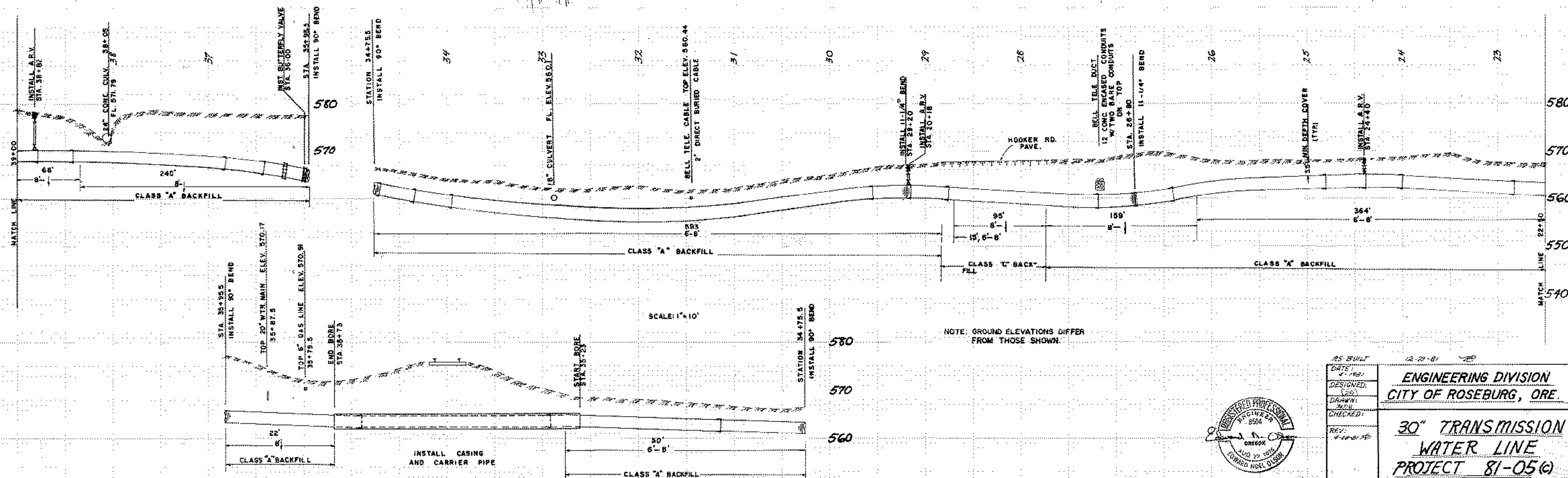
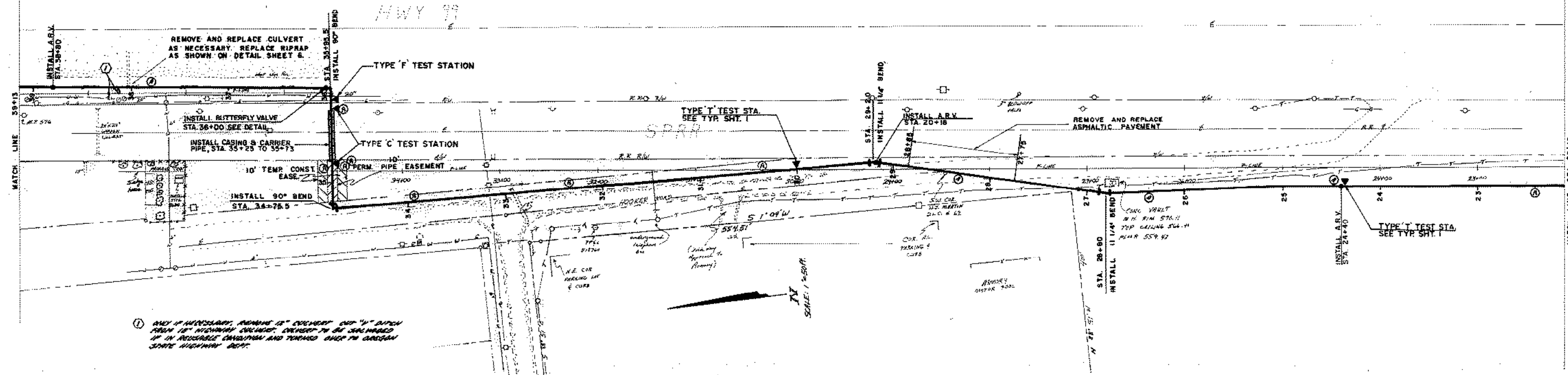
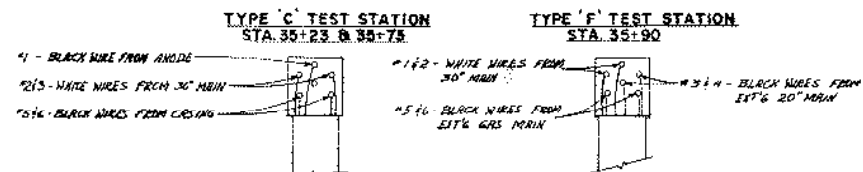


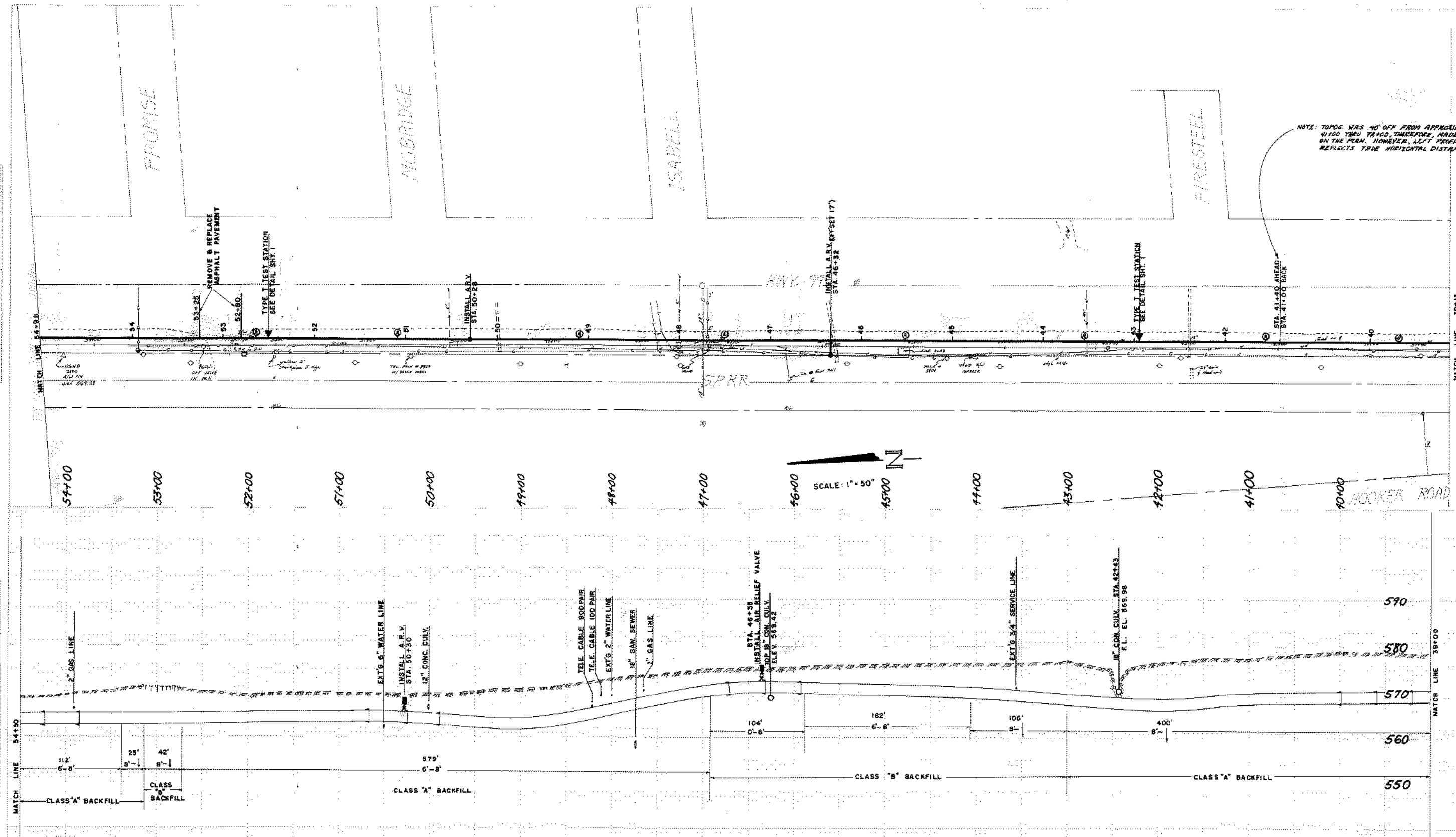
PLATE 4-SINGLE PLAN AND CROSS SECTION, P. 007
 12-20-81
 12-20-81



DESIGNED BY	12-20-81
DESIGNED	ENGINEERING DIVISION
DRAWN	CITY OF ROSEBURG, ORE.
CHECKED	
REV.	
30" TRANSMISSION WATER LINE PROJECT 81-05(c)	
SHEET 2 OF 6 SHEETS	

PLAN	DATE	BY	CHK
DESIGNED: [Signature]			
DRAWN: [Signature]			
CHECKED: [Signature]			
APPROVED: [Signature]			

PROFILE	DATE	BY	CHK
DESIGNED: [Signature]			
DRAWN: [Signature]			
CHECKED: [Signature]			
APPROVED: [Signature]			



NOTE: TOPOG. WAS 40' OFF FROM APPROXIMATE STATIONS 41+00 THRU 42+00, THEREFORE, HAD TO ADJUST EQUATION ON THE PLAN. HOWEVER, LEFT PROFILE AS IS WHICH REFLECTS TRUE HORIZONTAL DISTANCE.

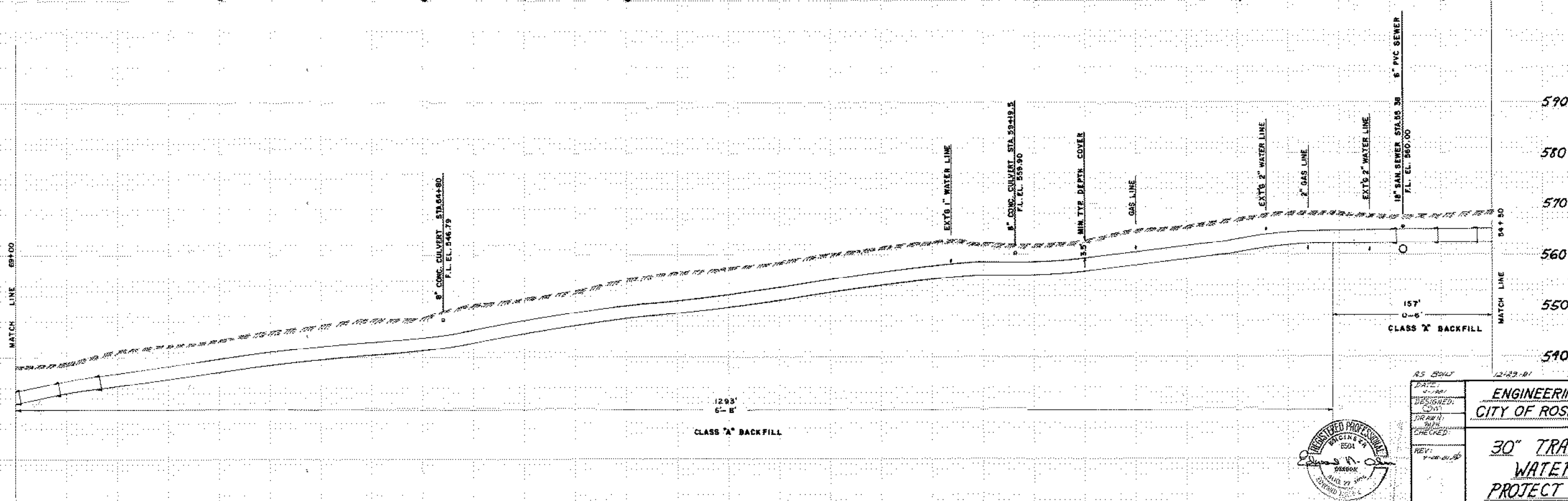
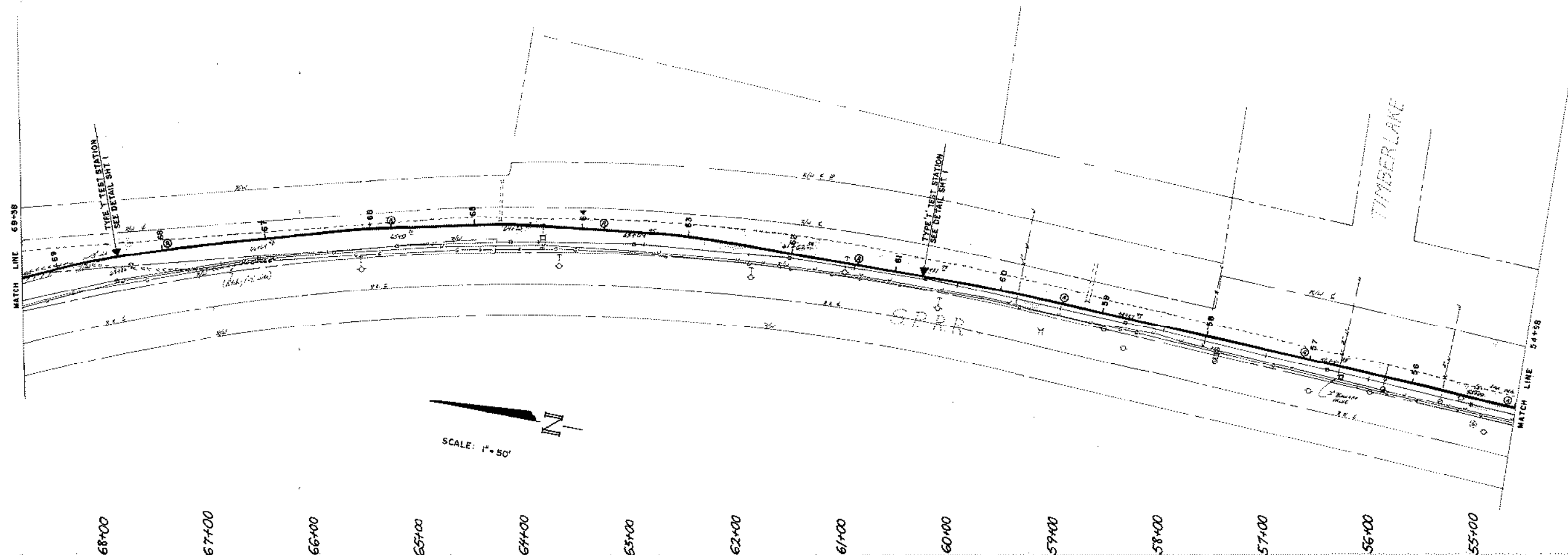
NOTE: GROUND ELEVATIONS VARY FROM THOSE SHOWN.



AS-BUILT	12-29-81	TE
DATE:	12-29-81	
DESIGNED:	[Signature]	
DRAWN:	[Signature]	
CHECKED:	[Signature]	
REV:	12-29-81	
ENGINEERING DIVISION CITY OF ROSEBURG, ORE.		
30" TRANSMISSION WATER LINE PROJECT 81-05(c)		
SHEET 3 OF 6 SHEETS		

DESIGN	DATE	BY
REVISION	DATE	BY
APPROVED	DATE	BY

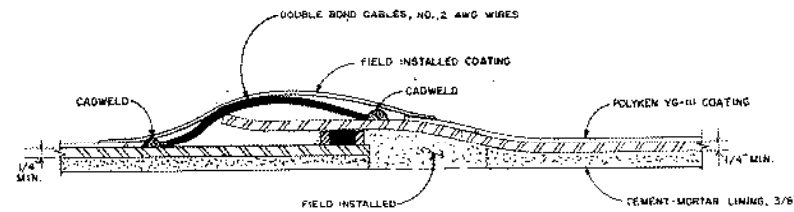
ORIGINAL	DATE	BY
REVISION	DATE	BY
APPROVED	DATE	BY



R.S. BULL DATE: 12-23-01 DESIGNED: CON DRAWN: RJB CHECKED: REV: 1-10-01		ENGINEERING DIVISION CITY OF ROSEBURG, ORE. 30" TRANSMISSION WATER LINE PROJECT 81-05 (c)
SHEET 4 OF 6 SHEETS		

PLATE 4-SINGLE PLAN AND CROSS SECTION (SCALE 1/2")
 DRAWING NO. 81-05 (c)
 DATE: 12-23-01

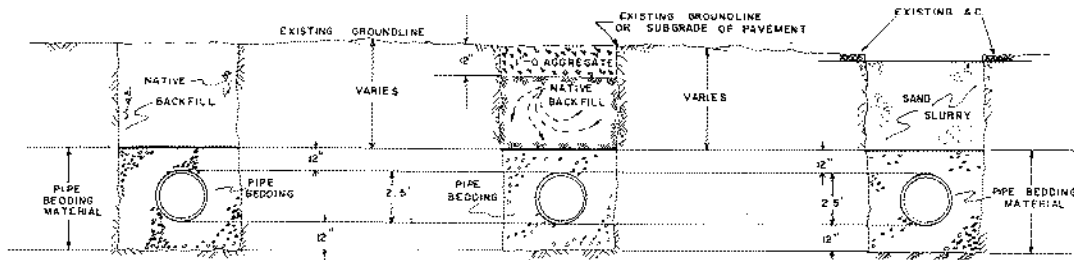
FINAL	DESIGNED	DATE
SURVEY	BY	DATE
NOTED	BY	DATE
APPROVED	BY	DATE
BY	DATE	



TYPICAL CROSS SECTION "O"-RING BELL & SPIGOT JOINT (see note "A")
(NTS)

NOTE A:

- Assembly of "O" Ring Joint:
 - Place o-ring gasket in groove on spigot end, snap gasket against pipe 3 or 4 times around circumference to relieve twist.
 - Using lubricant furnished with pipe, lightly coat inside surface of bell end (approx. 3-1/2" around full circumference) and just the top of the o-ring gasket as it rests in the groove of the spigot end.
 - Line spigot end up with bell end squarely, start spigot into bell and push to normal seat depth, from far end.
 - Check gasket with feeler gauge to insure that normal seat has been attained for full circumference.
- Joint bonding cables and bolts, nuts and washers for cathodic protection are optional. When required assemble in accordance with notes 3 and 4.
- Assemble joint bonding cable as shown, after joint assembly hex head bolts will be shop installed in hex nut prior to coating and lining of pipe.
- Prior to joint assembly, as covered by note 1, contractor must locate, uncover and align bonding nuts and bolts on adjacent pipe ends.



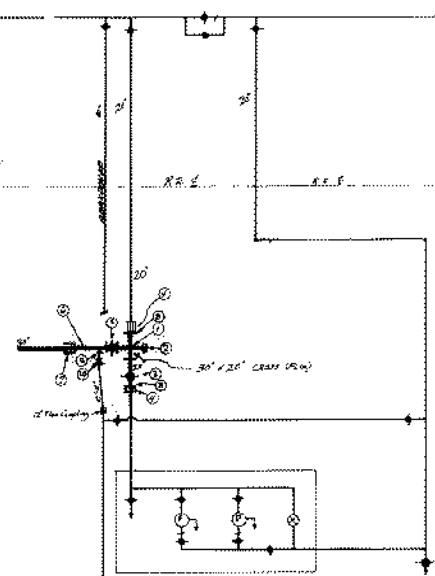
TRENCH EXCAVATION
CLASS "A"

TRENCH EXCAVATION
CLASS "B" (1'-0" AGGREGATE)

TRENCH EXCAVATION
CLASS "C" BACKFILL
(SAND SLURRY)

NOTE: PAY DEPTHS
0'-6"
6'-8"
(INCLUSIVE)
8'-1'

FINAL	DESIGNED	DATE
SURVEY	BY	DATE
NOTED	BY	DATE
APPROVED	BY	DATE
BY	DATE	



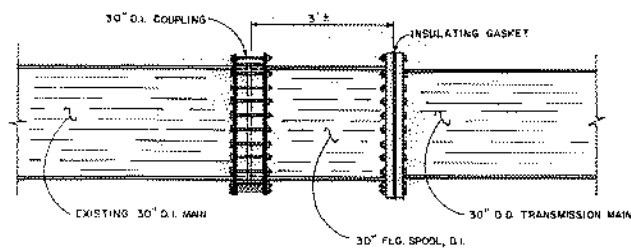
DETAIL "A" SEE
SHEET 1
STA. 10+20.5
(NTS)

NOTES:

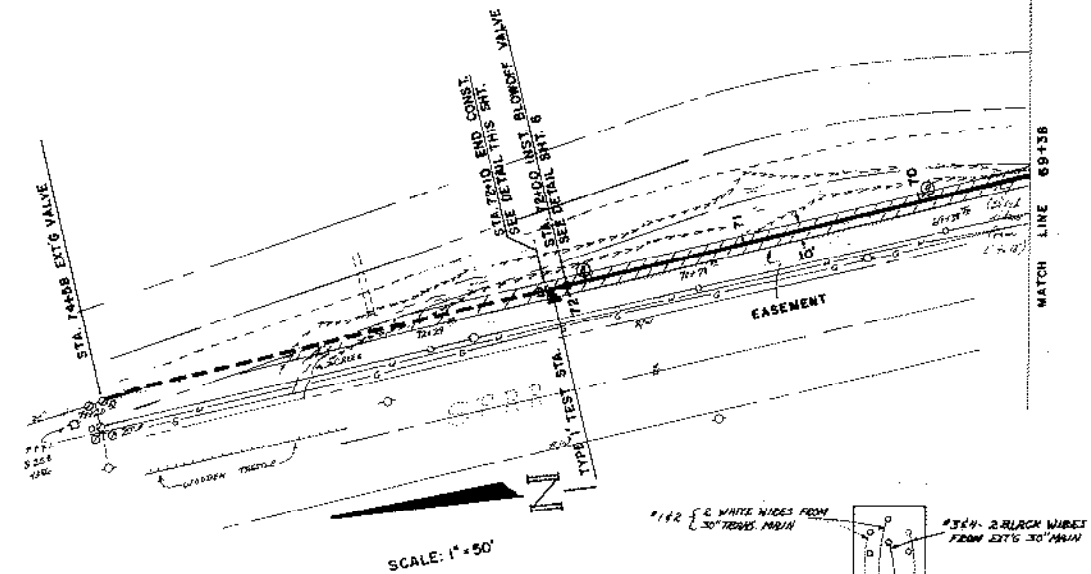
- NO DIRECT PAYMENT WILL BE MADE FOR INSTALLATION OF VALVES OR FITTINGS ON EXISTING 20" MAIN. COST OF THIS WORK SHALL BE INCLUDED IN OTHER PAY ITEMS.
- TIE IN TO EXISTING 20" PIPE SHALL NOT BE DONE FROM JUNE 15 THROUGH SEPT. 15, UNLESS APPROVED BY ENGINEER.

- 20" x 30" Cross Fig.
- 30" Blind Flange
- 20" Fig. Butterfly Valve
- 20" Fig. Coupling
- 30" Fig. Butterfly Valve
- 30" Fig. x 20" Flange (30" O.D. Steel)
- 30" Rubber Coupling (30" O.D.)
- 20" Insulating Gasket For
- 12" Fig. Outlet w/ 1" Fig. Spool
- 12" Gate Valve

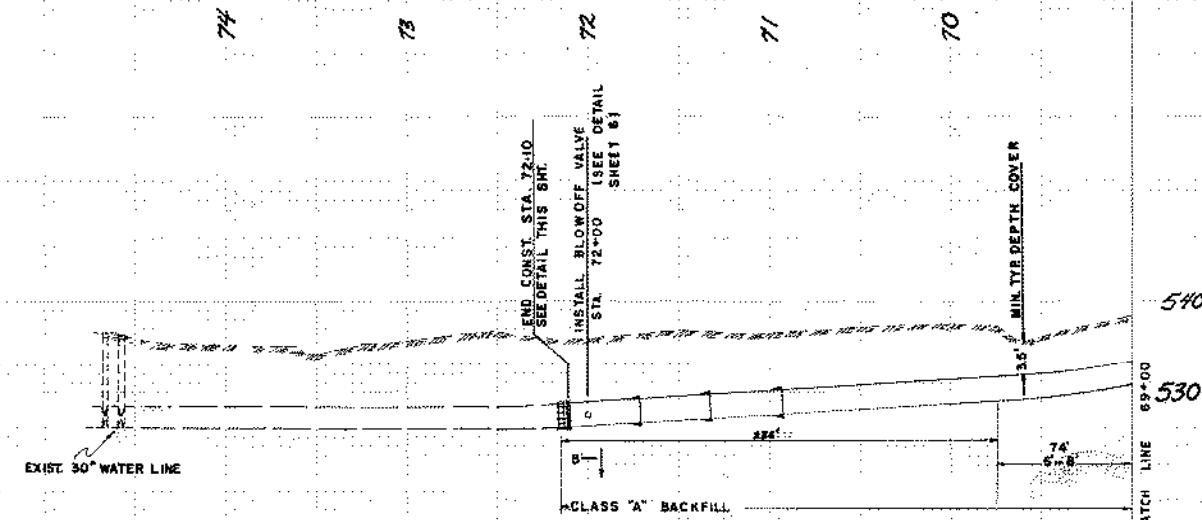
1" BONDING REQUIRED ACROSS COUPLING



DETAIL STATION 72+10
CONNECTION TO EXT'S MAIN



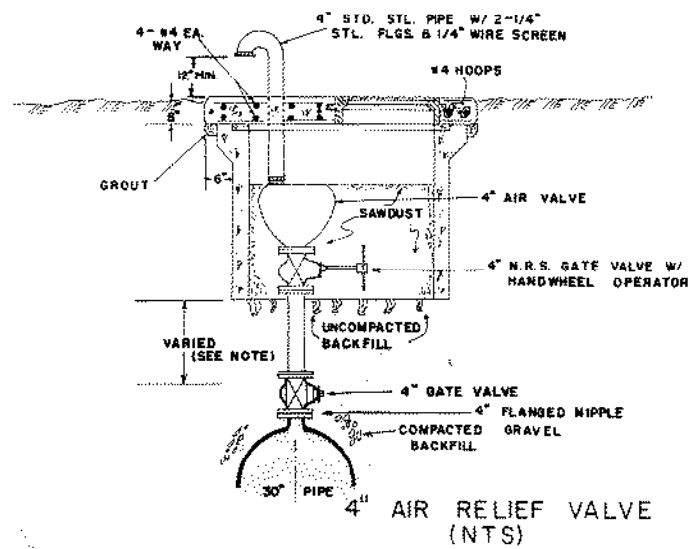
TYPE "I" TEST STATION
STATION 72+10



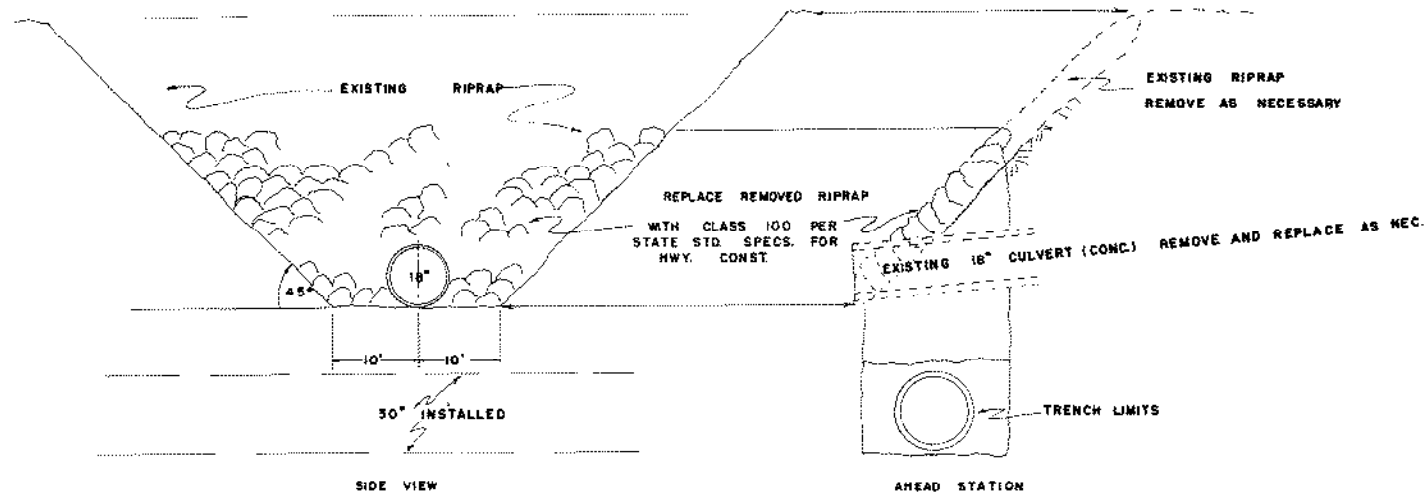
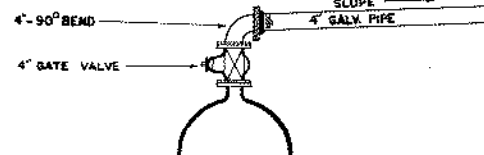
DATE: 8-1-81	ENGINEERING DIVISION
DESIGNED: (S-1)	CITY OF ROSEBURG, ORE.
DRAWN: M.A.	
CHECKED: (S-1)	
REV: 8-20-81	
	30" TRANSMISSION
	WATER LINE
	PROJECT 81-05(4)
	SHEET 5 OF 6 SHEETS

DESIGN	DATE
BY	DATE
CHECKED	DATE
APPROVED	DATE
REVISIONS	
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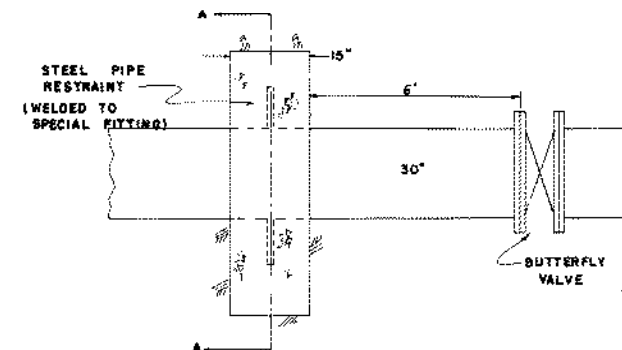
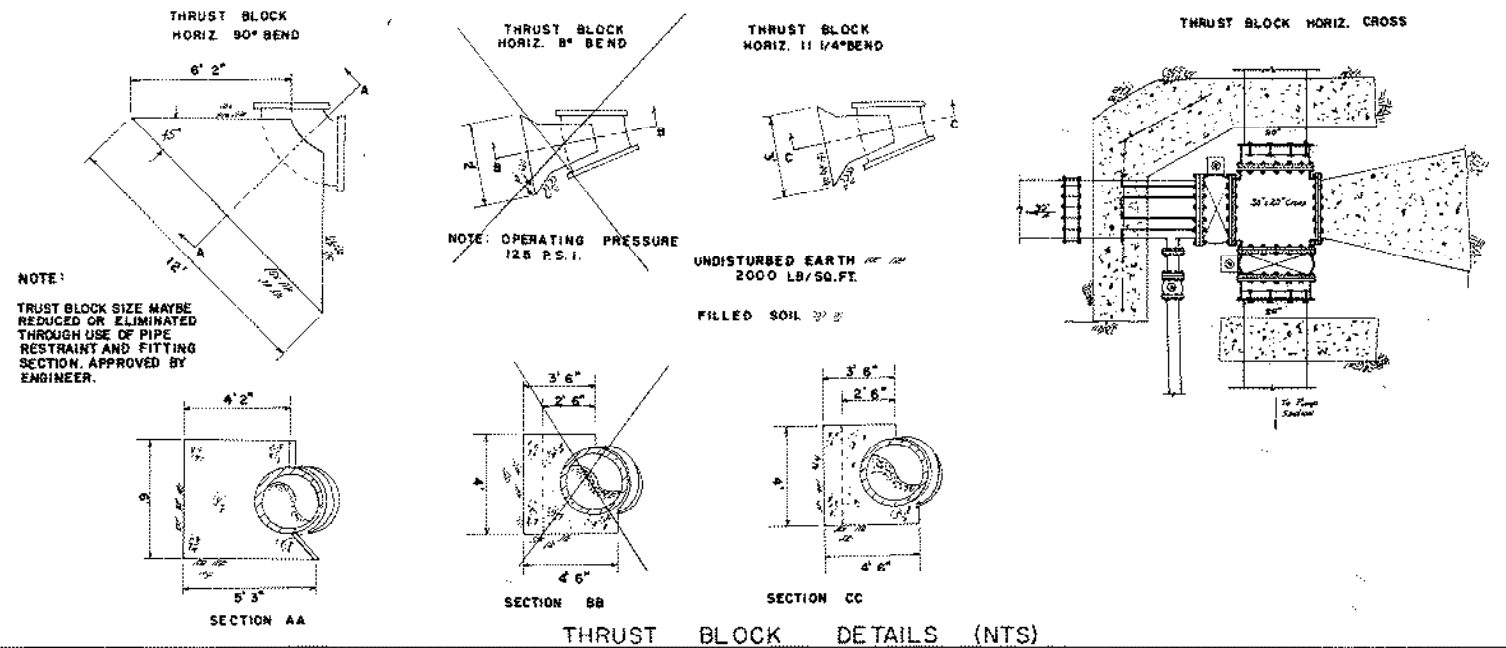
DESIGN	DATE
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CHECKED	DATE
APPROVED	DATE
REVISIONS	
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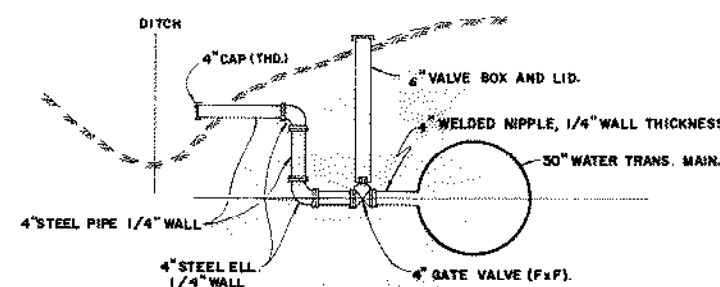
NOTE:
IF VALVE HOUSING CANNOT BE PLACED DIRECTLY OVER PIPE, THEN RUN LINE TO CONNECT AS REQUIRED, BUT INSURING THERE IS AN UPHILL SLOPE FROM STOP VALVE TO GATE VALVE.



CULVERT CROSSING
STA. 38+05
(NTS)



BUTTERFLY VALVE THRUST BLOCK
(NTS)



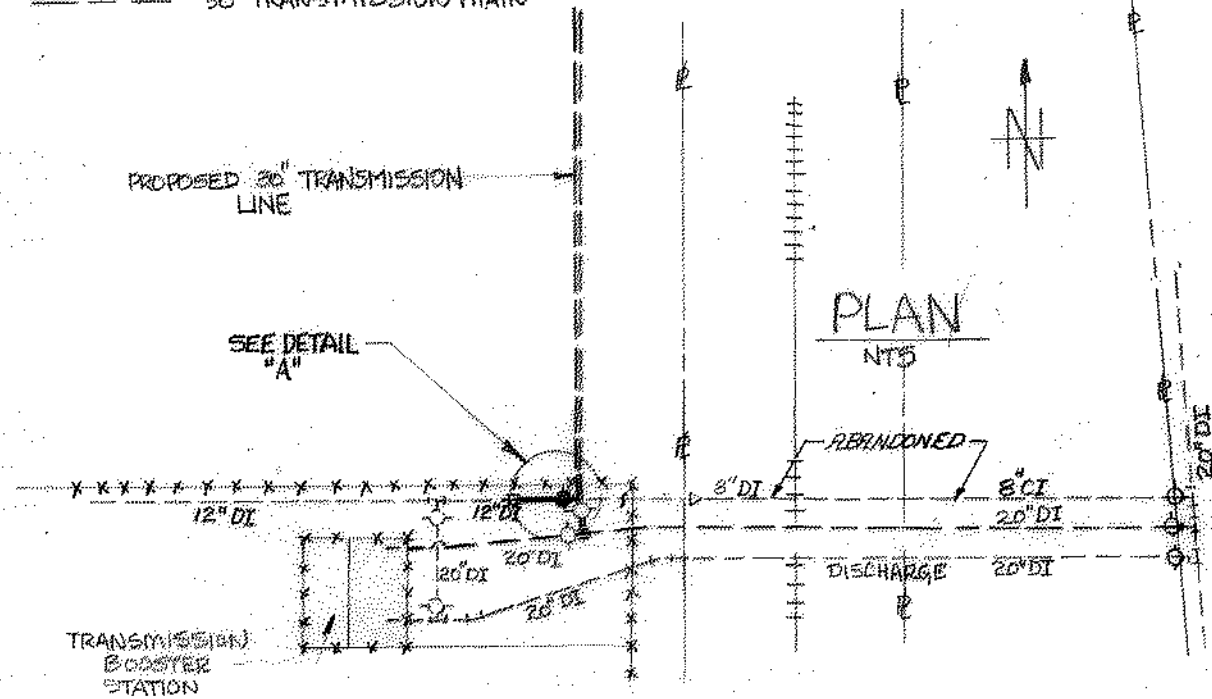
BLOW OFF DETAIL
STA. 72+00
(NTS)



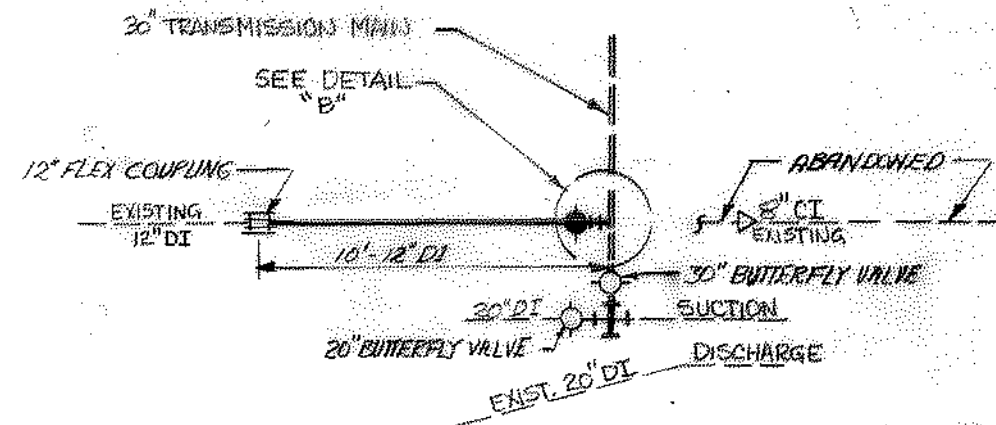
DATE: 4-1981	ENGINEERING DIVISION
DESIGNED: DM	CITY OF ROSEBURG, ORE.
DRAWN: DM	
CHECKED:	
REV: 9-25-81	30" TRANSMISSION WATER LINE PROJECT 81-05 (6)
SHEET 6 OF 6 SHEETS	

LEGEND

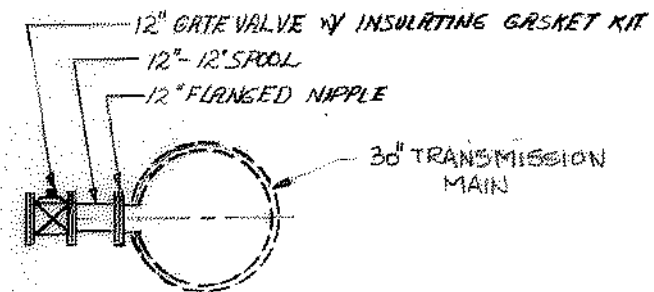
--- EXIST. WATER LINE
 --- PROPOSED WATER LINE (12")
 === 30" TRANSMISSION MAIN



PLAN
NTS



DETAIL "A"
NTS



DETAIL "B"
NTS

MATERIAL

CITY
 10' - 12" DI PIPE
 1 - 12" FLEX COUPLING
 1 - 12" INSULATING FLG GASKET SET

CONTRACTOR

1 - 12" NIPPLE
 1 - 12" FLANGE

AS BUILT 2-1-82 R

12" TIE IN TO 30" TRANS. MAIN
 AT TRANS. BOOSTER
 (ABANDON 25' OF 8" CI)

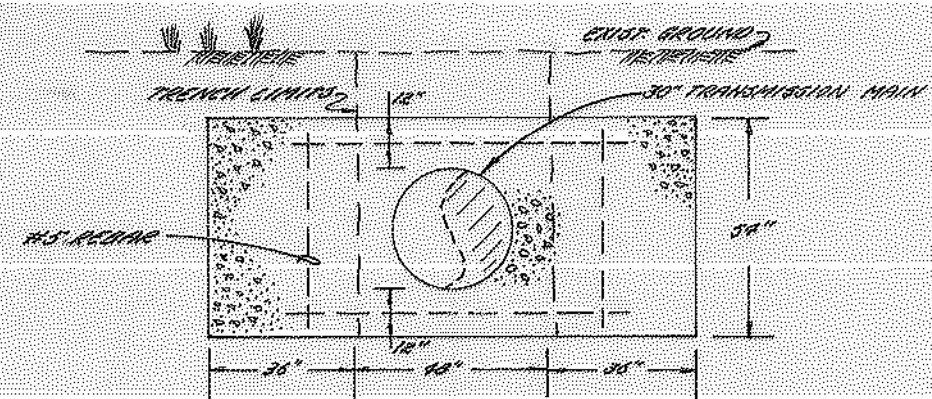
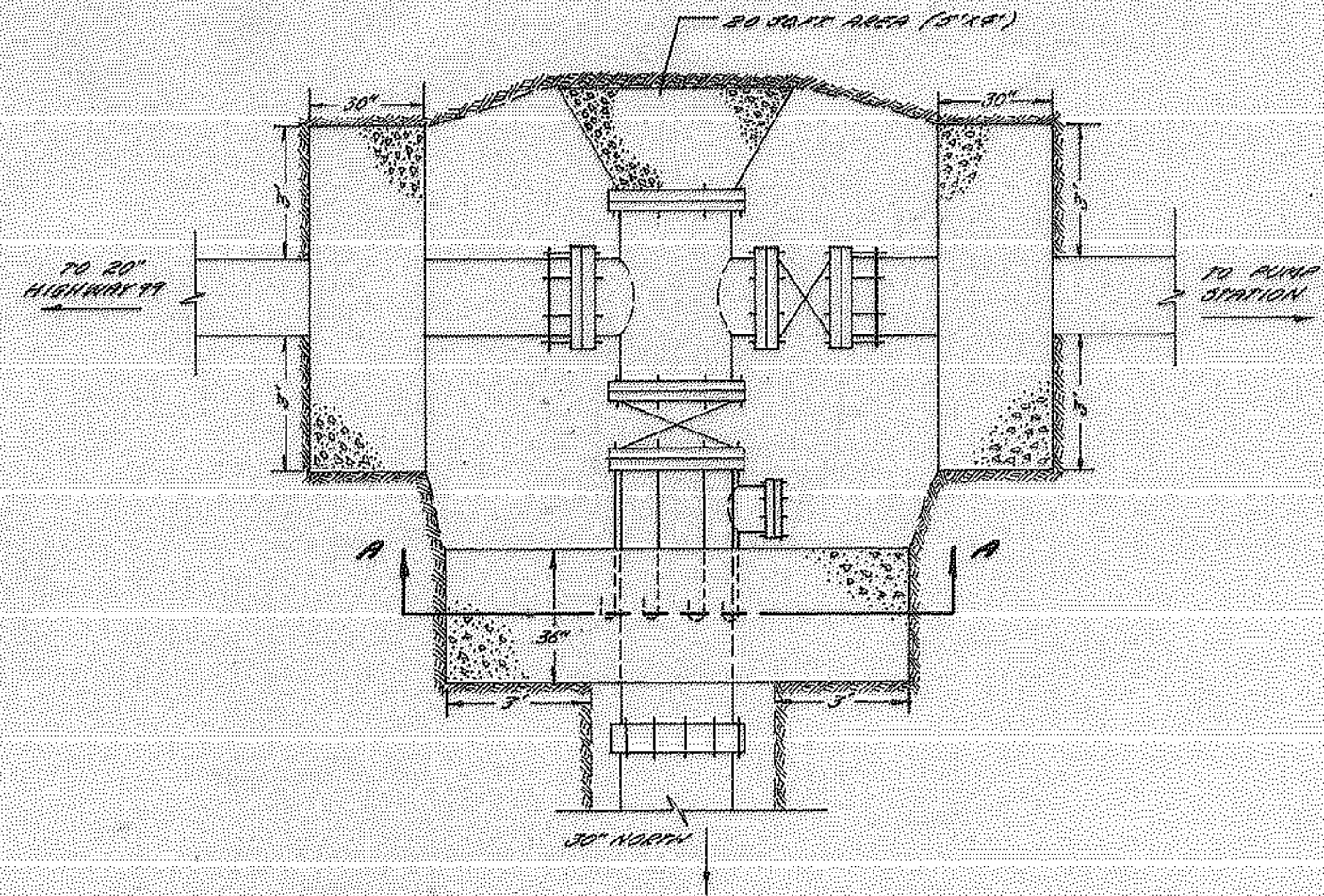
SCALE NONE	APPROVED <i>GW</i>	DRAWN CSM
DATE 6/81		REVISED

WATER DEPARTMENT

ROSEBURG OREGON

81-05(c)

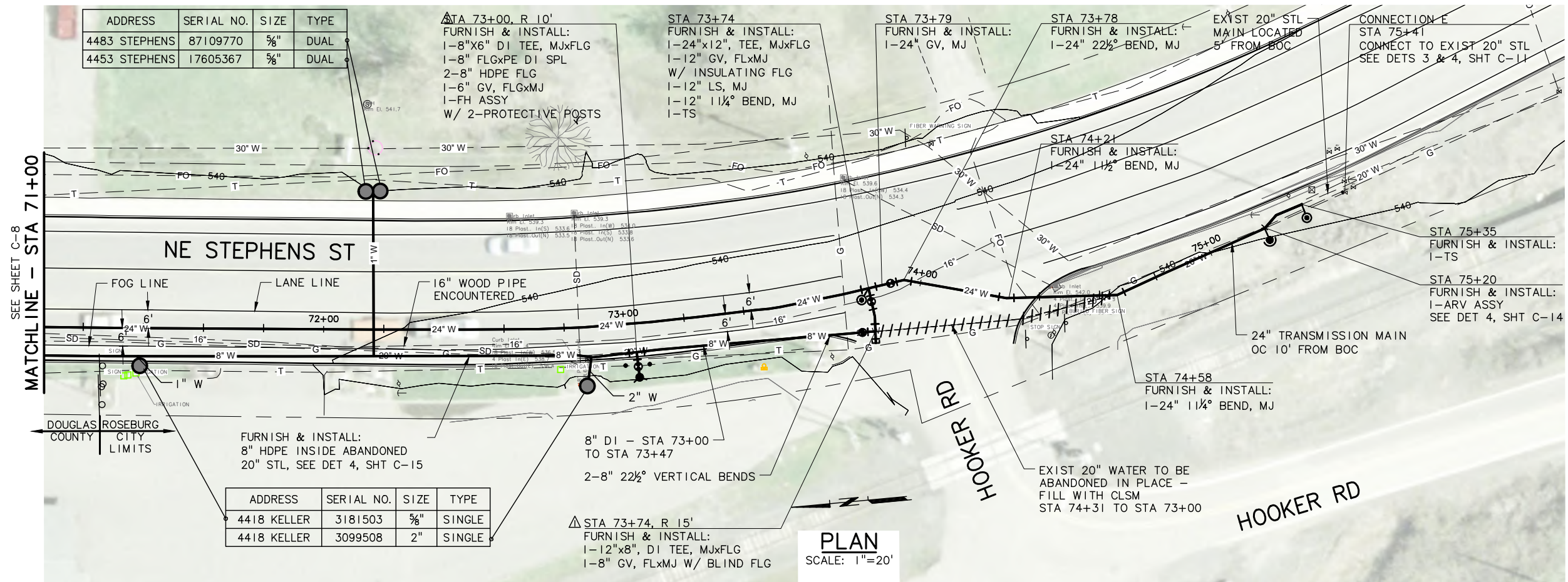
30" TRANSMISSION MAIN (81-056)
TIE-IN TO 20" SUCTION



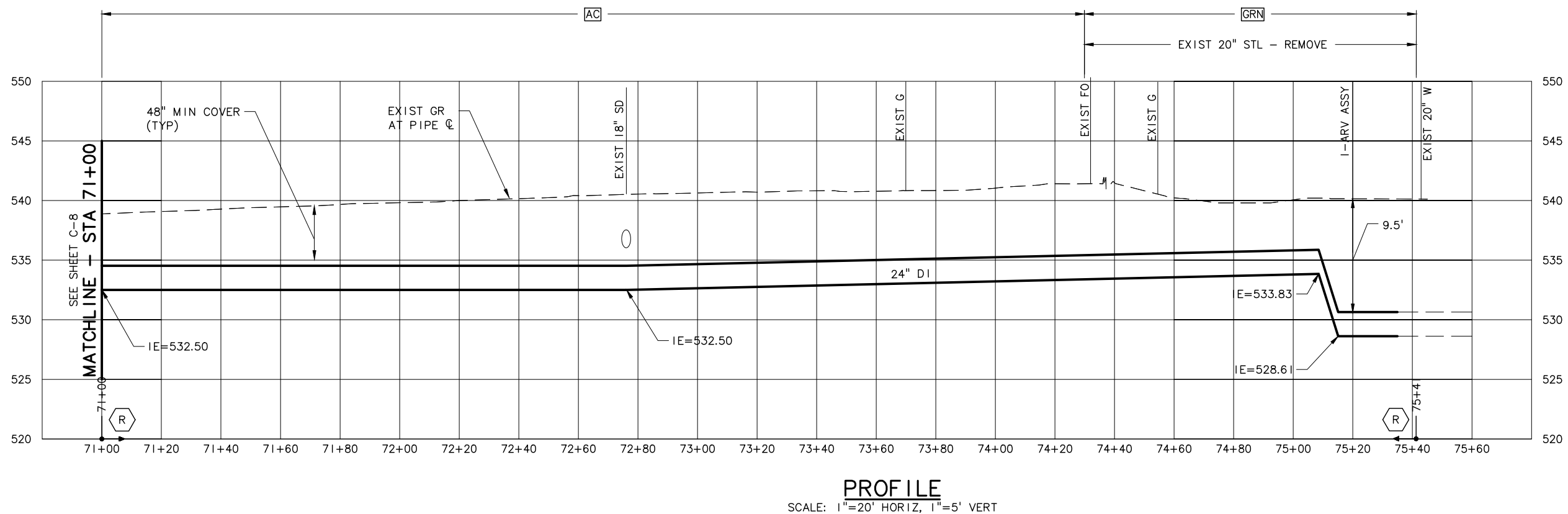
SECTION A-A

11-9-01 JH

G:\PDX_Projects\12\1297\CAD\DOR PHASE 1\1297-OR-C4_C-9-C-11-PH1_R.dwg C-9 3/3/2014 2:23 PM RLF 18.2s (LMS Tech)



- NOTES:
1. MINIMUM 48" COVER ON NEW TRANSMISSION MAIN UNLESS SHOWN OTHERWISE.
 2. MINIMUM 36" COVER ON NEW DISTRIBUTION MAINS UNLESS SHOWN OTHERWISE.
 3. WHERE VERTICAL DEFLECTION NOT SPECIFIED, CONTRACTOR TO DEFLECT PIPE AS NECESSARY TO ACHIEVE ALIGNMENT SHOWN. PIPE DEFLECTION LIMITED TO ONE-HALF MANUFACTURER'S RECOMMENDATIONS.
 4. SEE SHEET C-12 FOR TRENCH AND SURFACE RESTORATION REQUIREMENTS.



NO.	DATE	BY	REVISION
1	02/07/14	PHS	RECORD DRAWINGS
2	10/01/12	PHS	MODIFY HDPE CONNECTIONS

NOTICE

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

SEL/TRN/PHS

DESIGNED

RLF

DRAWN

PHS

CHECKED

RECORD DRAWING

SEE DISCLAIMER, SHEET 1.

VERSION 4.1

12-9-97

MSA

Murray Smith & Associates, Inc.

Engineers/Planners

175 West B Street, Bldg K-2 PHONE 541-741-2975
Springfield, Oregon 97477 FAX 541-744-3875



CITY OF ROSEBURG

24-INCH WATER TRANSMISSION MAIN FROM THE WTP TO HOOKER ROAD

PHASE 1

TRANSMISSION MAIN PLAN AND PROFILE

STA 71+00 TO STA 75+41

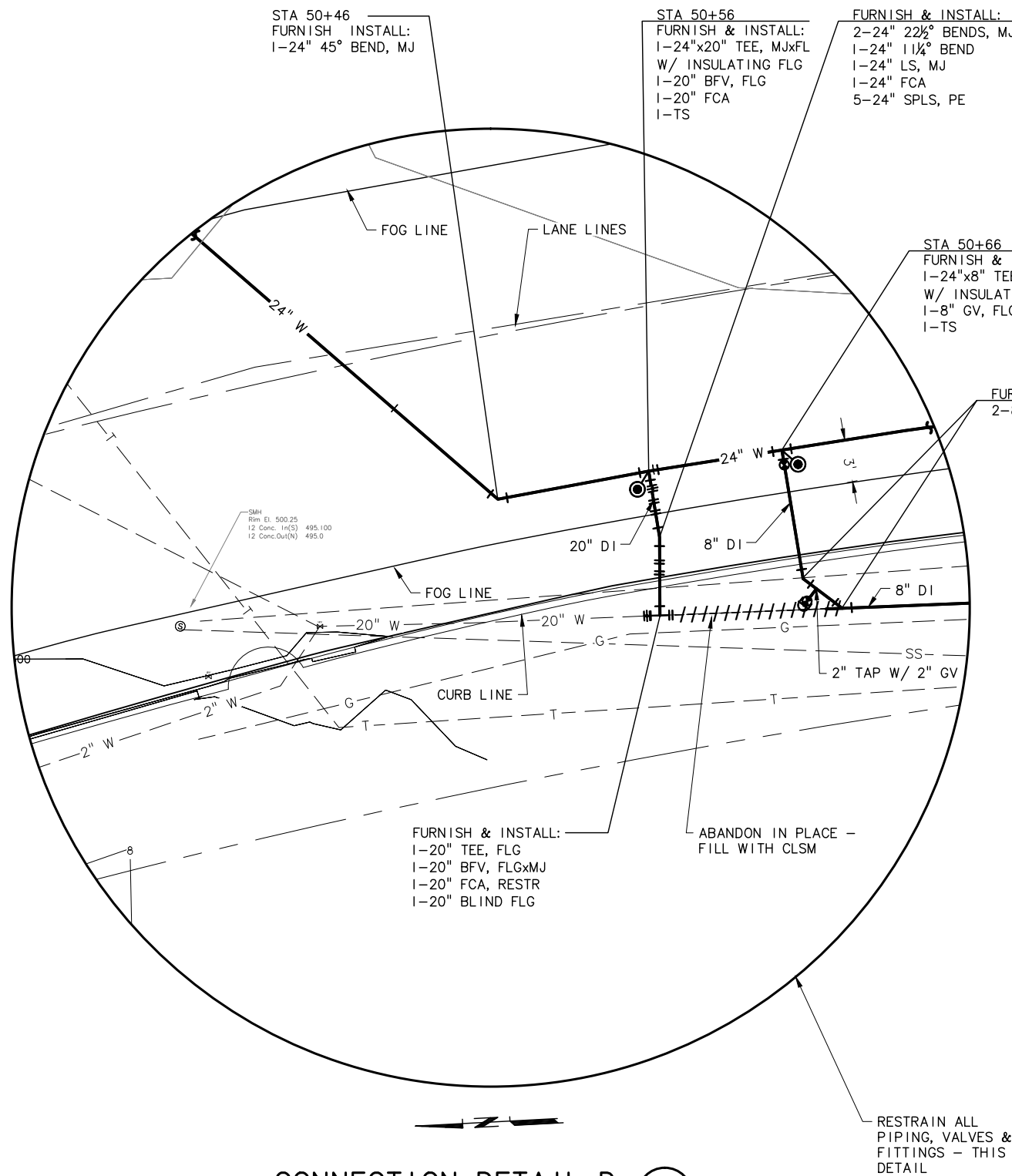
PROJECT NO.: 12-1297.916 SCALE: AS SHOWN DATE: JULY 2012

SHEET

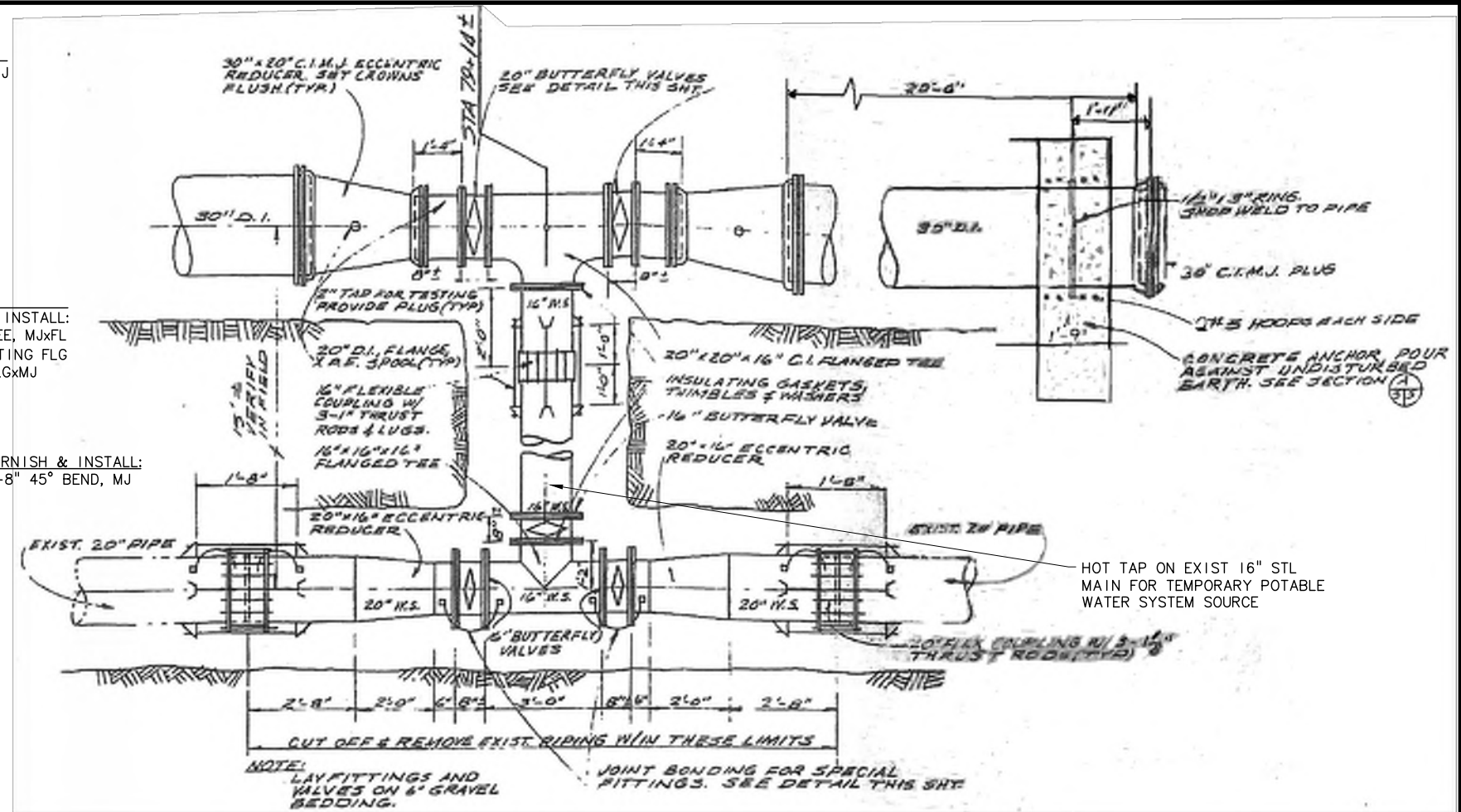
C-9

14 of 28

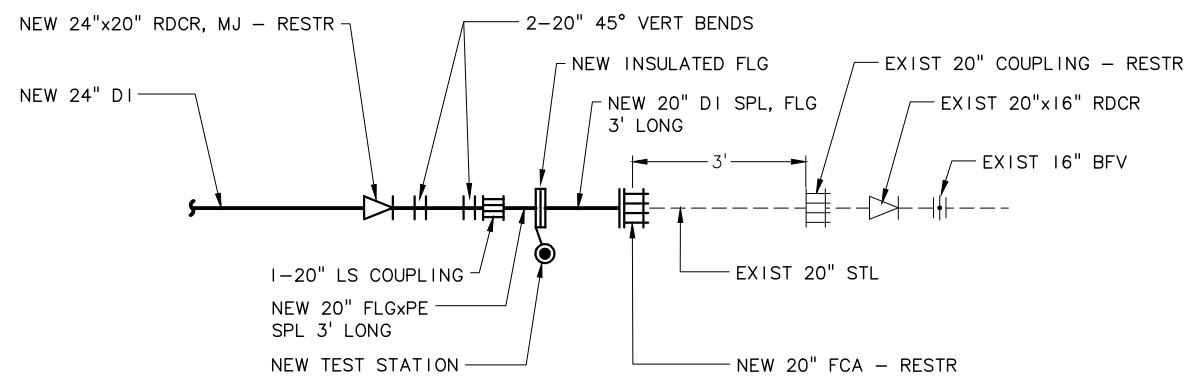
G:\PDX_Projects\12\1297\CAD\DOR PHASE 1\1297-OR-C4_C-9-C-11-PH1_R.dwg C-11 2/27/2014 10:04 AM RLF 18.2s (LWS Tech)



CONNECTION DETAIL D (1)



EXISTING TRANSMISSION MAINS
INTER Tie, SOUTH OF HOOKER ROAD (2)



CONNECTION DETAIL E (3)

NO.	DATE	BY	REVISION
1	02/07/14	PHS	RECORD DRAWINGS
2	10/01/12	PHS	MODIFY HDPE CONNECTION

NOTICE
0 1/2 1
IF THIS BAR DOES
NOT MEASURE 1"
THEN DRAWING IS
NOT TO SCALE

SEL/TRN/PHS
DESIGNED
RLF
DRAWN
PHS
CHECKED

RECORD
DRAWING
SEE DISCLAIMER,
SHEET 1.
VERSION 4.1
12-9-97

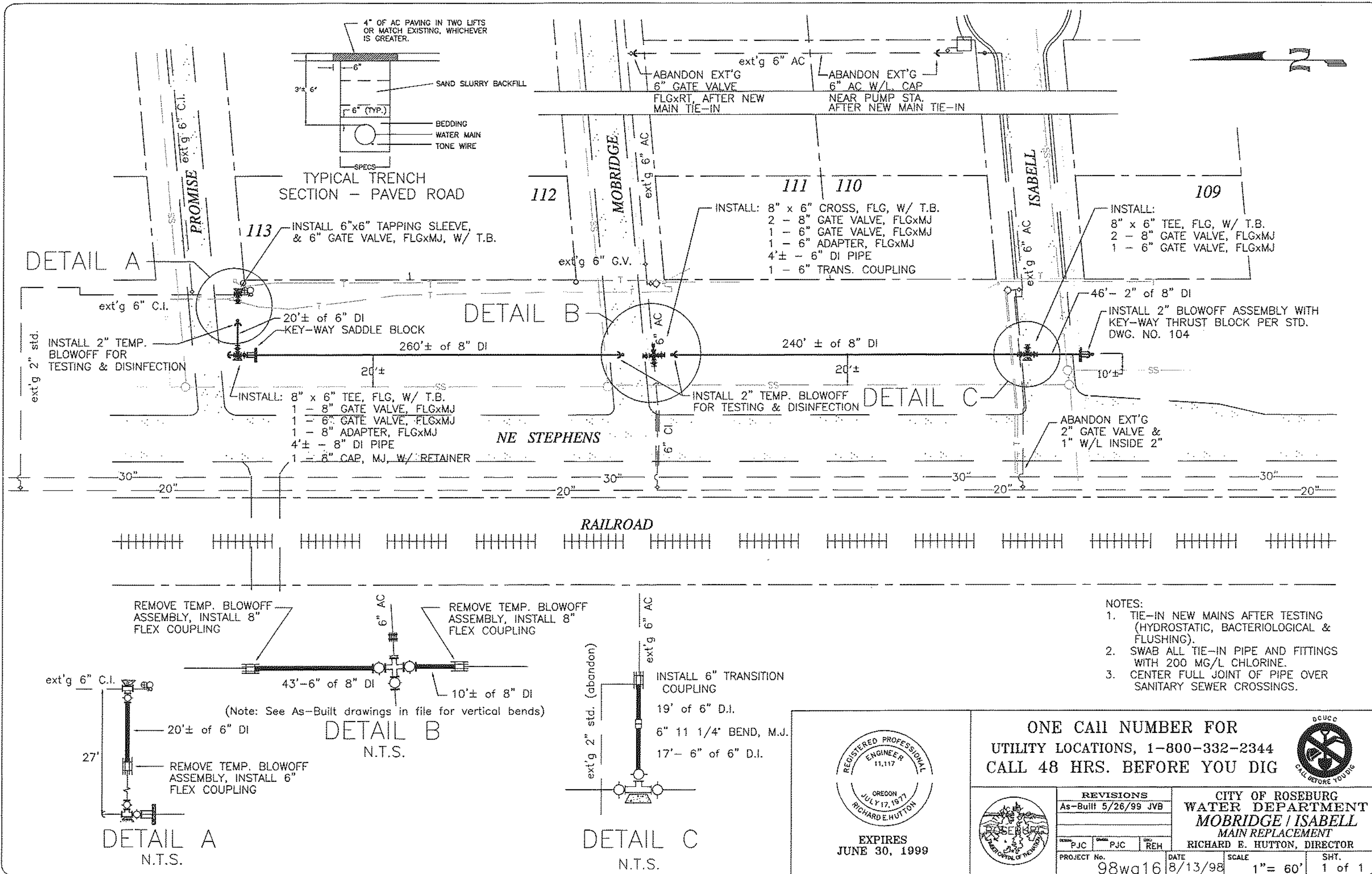
MSA Murray Smith & Associates, Inc.
Engineers/Planners
175 West B Street, Bldg K-2 PHONE 541-741-2975
Springfield, Oregon 97477 FAX 541-744-3875



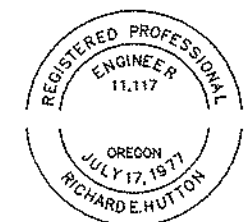
CITY OF ROSEBURG
24-INCH WATER
TRANSMISSION MAIN
FROM THE WTP TO
HOOKER ROAD
PHASE 1

CONNECTION DETAILS - 2
PROJECT NO.: 12-1297.916 SCALE: AS SHOWN DATE: JULY 2012

SHEET
C-11
16 of 28



- NOTES:**
1. TIE-IN NEW MAINS AFTER TESTING (HYDROSTATIC, BACTERIOLOGICAL & FLUSHING).
 2. SWAB ALL TIE-IN PIPE AND FITTINGS WITH 200 MG/L CHLORINE.
 3. CENTER FULL JOINT OF PIPE OVER SANITARY SEWER CROSSINGS.



**EXPIRES
JUNE 30, 1999**

**ONE CALL NUMBER FOR
UTILITY LOCATIONS, 1-800-332-2344
CALL 48 HRS. BEFORE YOU DIG**

**CITY OF ROSEBURG
WATER DEPARTMENT
MOBRIDGE / ISABELL
MAIN REPLACEMENT
RICHARD E. HUTTON, DIRECTOR**

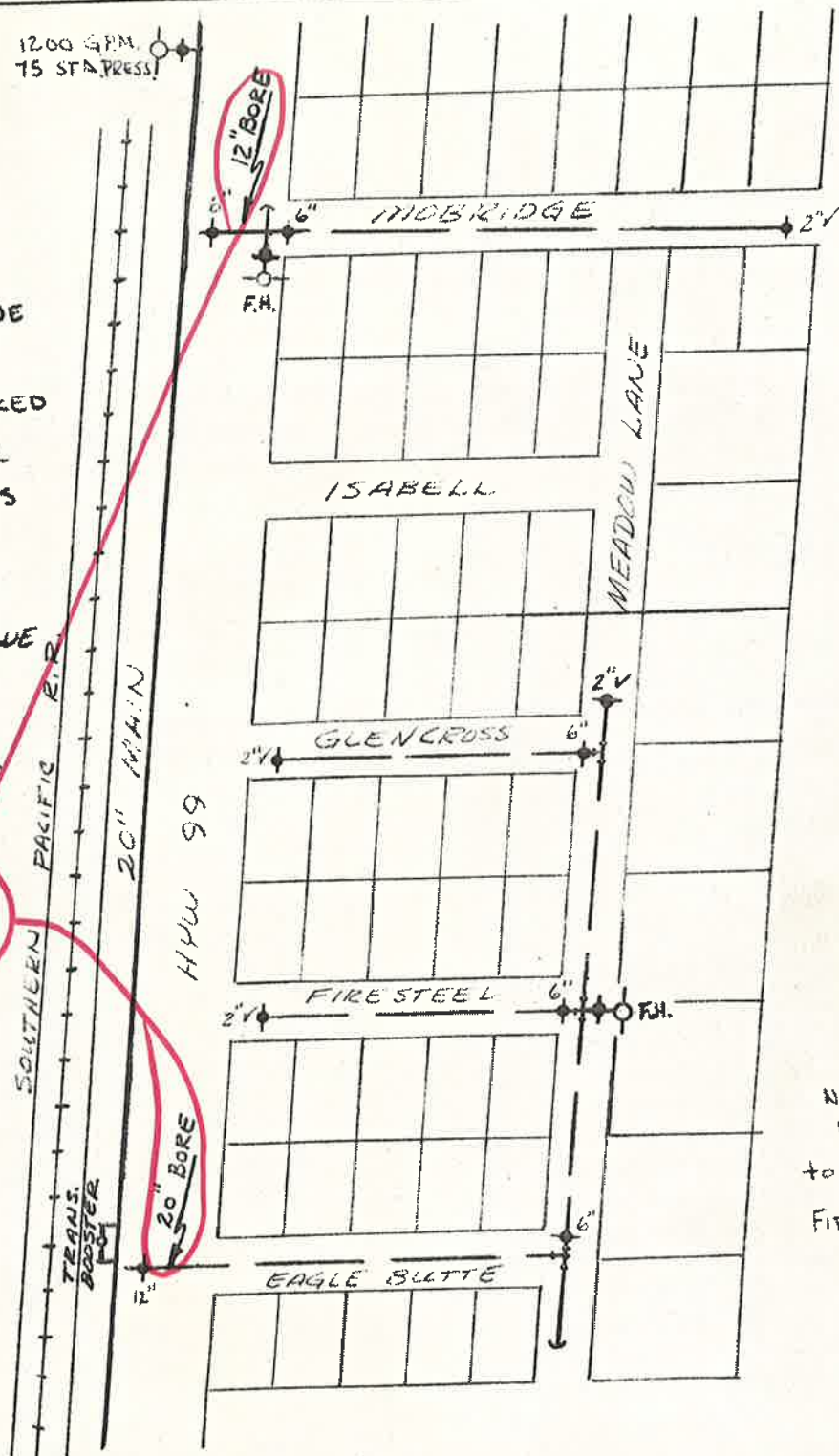
REVISIONS		
As-Built 5/26/99 JVB		
DESIGN	PJC	CHK
PROJECT No.	DATE	SCALE
98wa16	8/13/98	1" = 60'
		SHT.
		1 of 1

1200 GPM.
75 STAT. PRESS.

ESTIMATED MATERIALS

- 600' 12" C.I. PIPE
- 1950' 6" C.I. PIPE
- 1 12" TAPPING VALVE
- 1 12" TEE
- 1 12" CAP & BLOCKED
- 1 12"x6" REDUCER
- 4 6" GATE VALVES
- 2 6" TEES
- 4 6" BLOW-OFFS
- 1 6" TAPPING VALVE
- 2 6" CROSS
- 2 FIRE HYD
- 2 6" HYD VALVES

- 2 BORED CASINGS -
- 20" x 250" x 44'
- 12" x 250" x 52'



MAP 5

NOTE:
FIRE HYD LOCATIONS
TO BE VERIFIED BY
FIRE DEPARTMENT

AS-BUILT (BORE & CASING)

OREGON WATER CORPORATION

SCALE: 1"=200'

APPROVED BY:

DRAWN BY: R.W.G.

DATE: 8-23-73

REVISED:

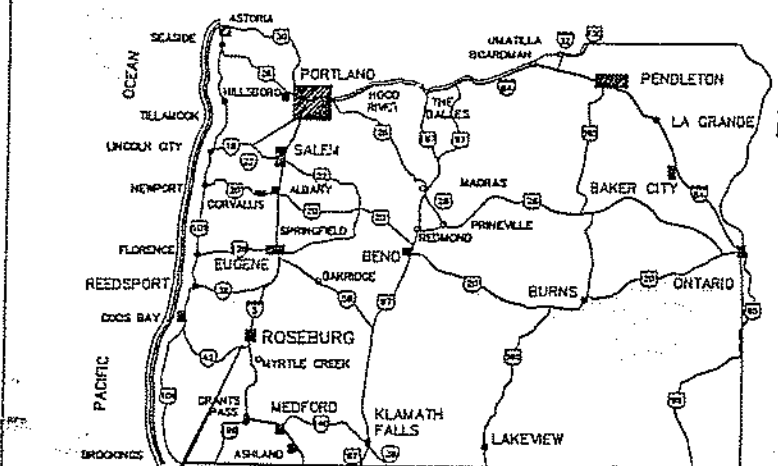
FETTMORE SUBDIVISION
FOR MR. BLIXETH

ROSEBURG, OREGON

DRAWING NO.

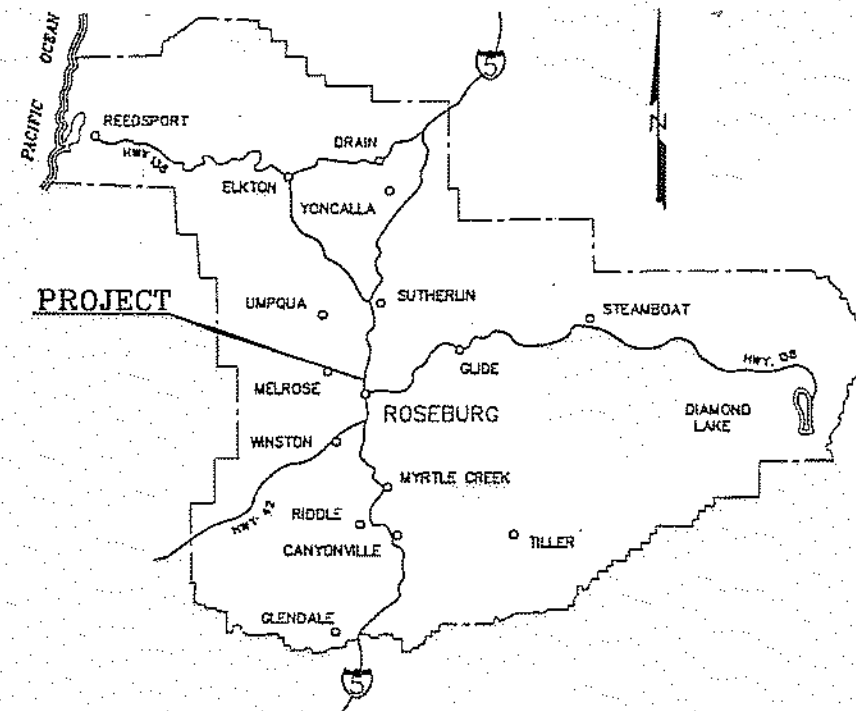
R-135-73

REV "B"



PROJECT STATE OF OREGON

DOUGLAS COUNTY, OREGON PLANS FOR RECONSTRUCTION OF NE STEPHENS ST. COUNTY ROAD #388 AND CONSTRUCTION OF NONPROFIT CAMPUS RD. 2003. *Asbuilt*



VICINITY MAP
N.T.S.

DRAWING INDEX - N. E. STEPHENS ST.

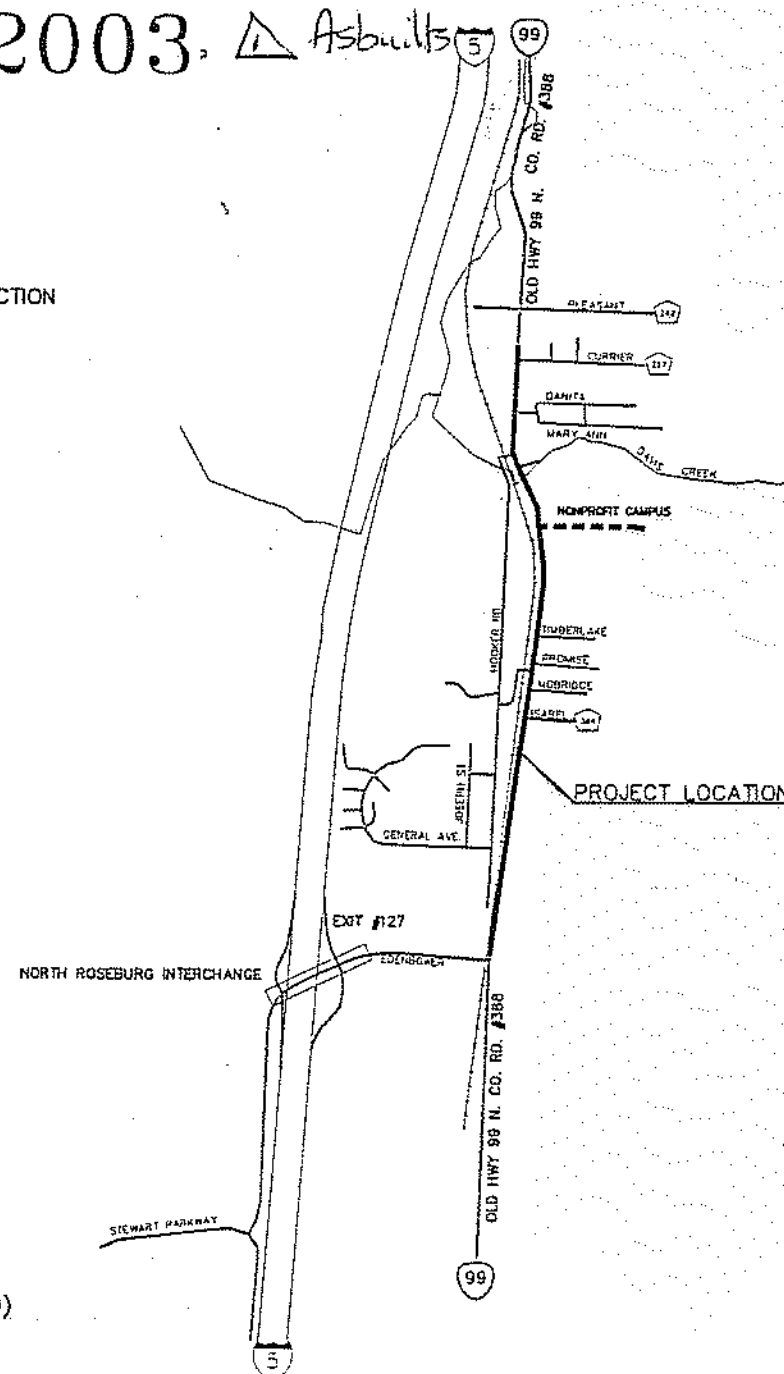
SHEET #	DRAWING
1	COVER
2-3	TYPICAL SECTIONS & DETAILS
4	TRAFFIC STAGING PLAN
5	TRAFFIC STAGING PLAN
6-7	PIPE DATA
8-17	PLAN & PROFILE
10A, 11A, 12A, 12B, 16A	WATERLINE PLAN/DETAILS
11B	SANITARY SEWER PLANS
NONPROFIT CAMPUS ROAD & INFRASTRUCTURE PLANS	

STANDARD/DETAIL DRAWINGS

RD100	MAILBOX INSTALLATION
RD342	SHALLOW MANHOLES
RD350	SANITARY SEWER INSIDE DROP CONNECTION
RD372	CONCRETE INLETS
RD374	AREA DRAINAGE BASIN
RD374	AREA DRAINAGE BASIN
RD700	CURBS
RD720	SIDEWALK
RD750	SIDEWALK DRIVEWAYS (OPTION M)
RD755	SIDEWALK RAMP DETAILS
RD760	SIDEWALK RAMP PLACEMENT
S-100	BARBED & WOVEN WIRE FENCE
RD815	CHAIN LINK FENCE
RD900	TRAFFIC CONTROL PLANS
RD910	TRAFFIC CONTROL PLANS
RD1035	SEDIMENT BARRIER TYPE 3
RD1055	MATTING
TM100	TEMPORARY SIGNS

CITY OF ROSEBURG STANDARD DRAWINGS

#102	THRUST BLOCKING
#103	VALVE AND VALVE BOX ASSEMBLY
#104	2" BLOWOFF ASSEMBLY
#105	FIRE HYDRANT ASSEMBLY (THRUST BLOCKED)
#108	WATER METER INSTALLATION ASSEMBLY



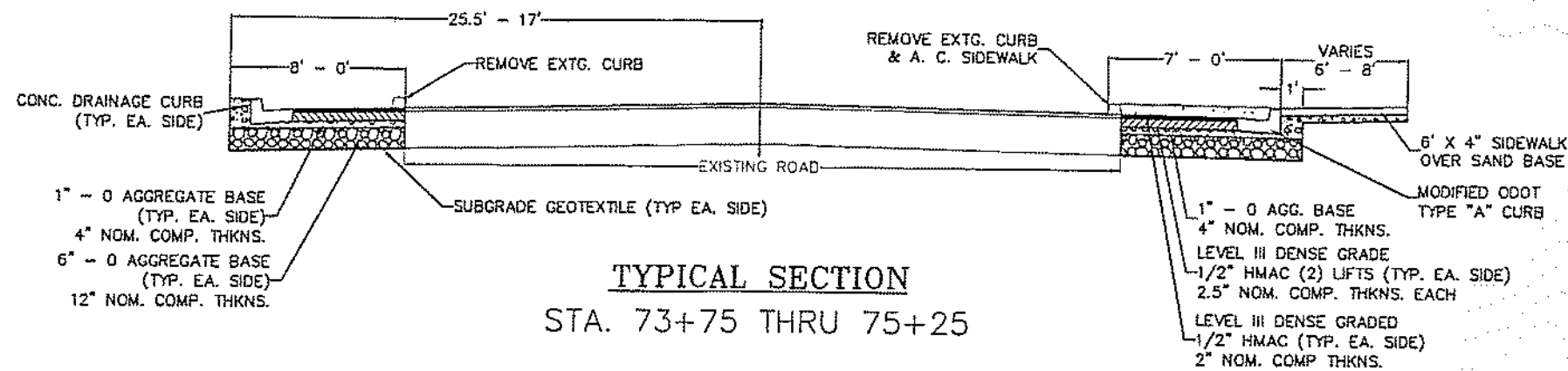
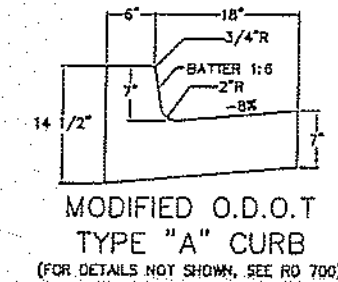
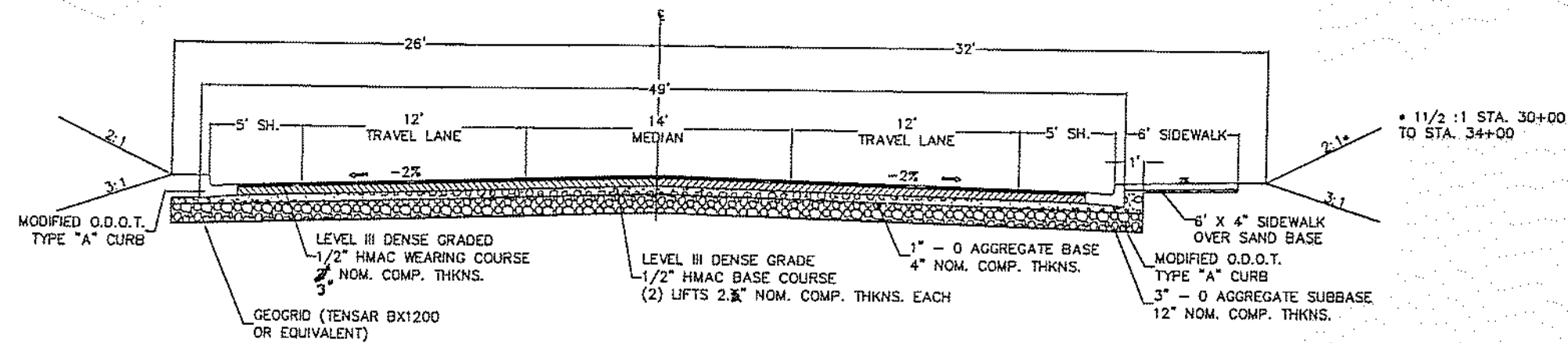
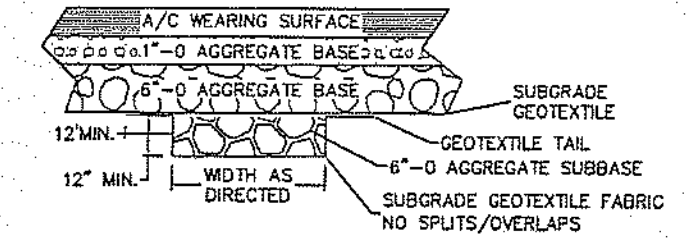
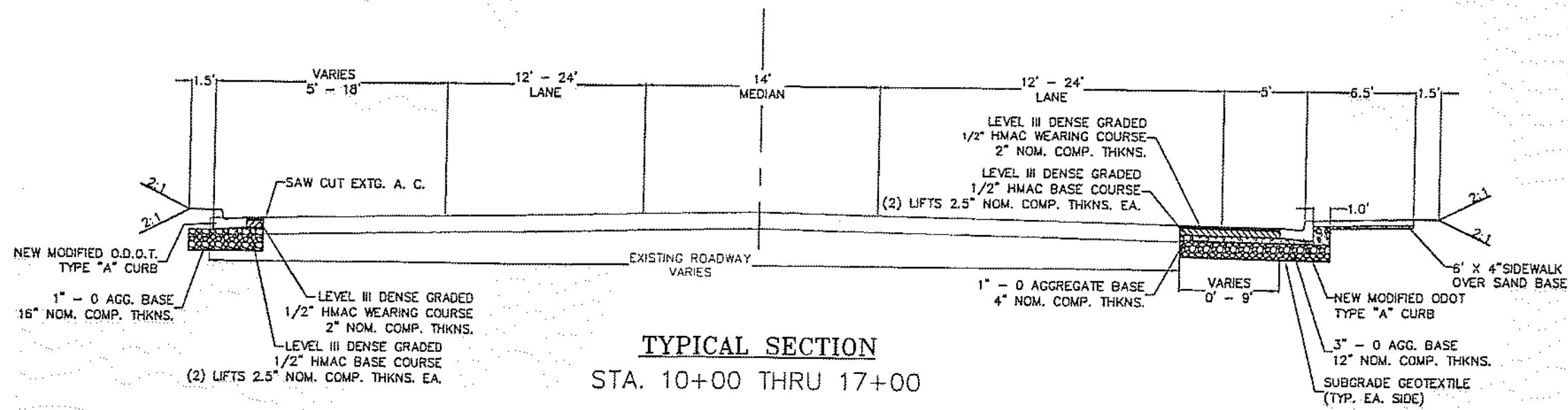
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ATTENTION:
Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0010 through OAR 952-001-0090. You may obtain copies of the rules by calling the center at 1-800-332-2344.

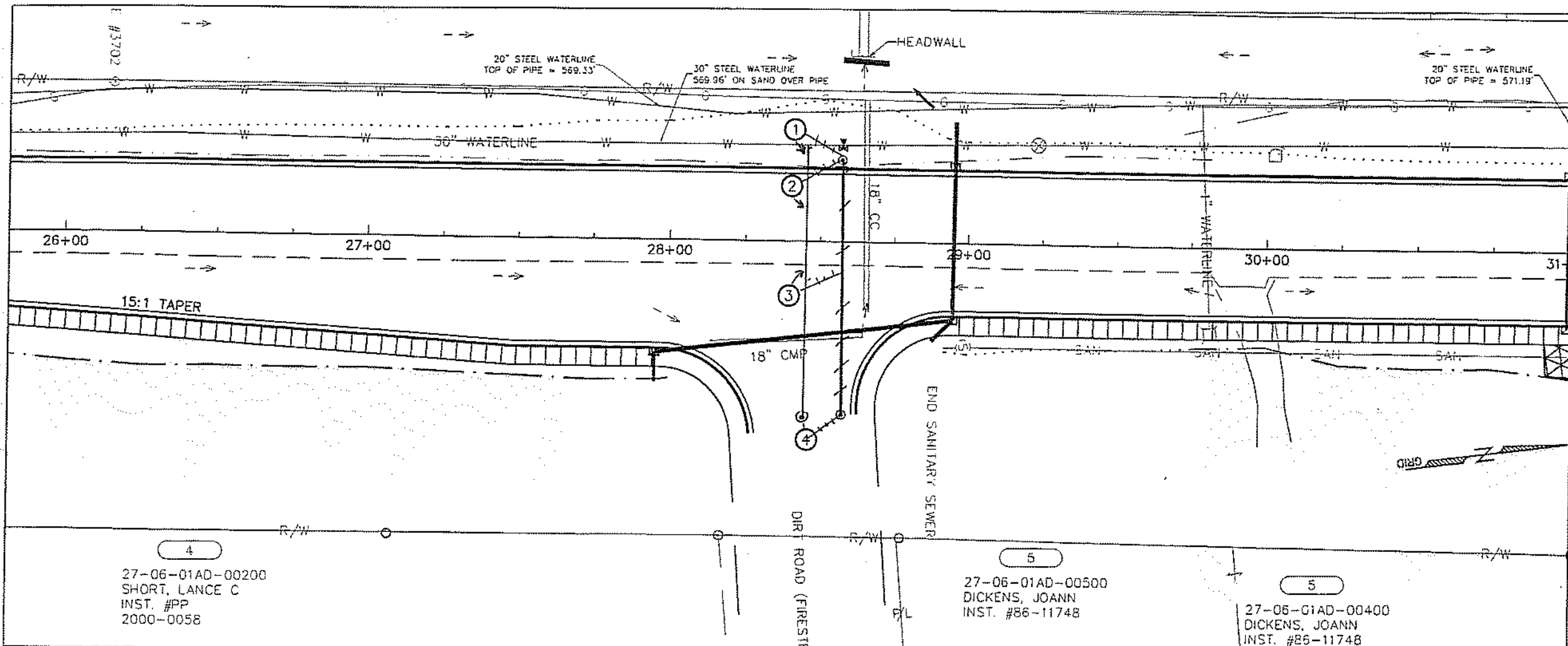


REVISIONS			DOUGLAS COUNTY DEPARTMENT OF PUBLIC WORKS	
NO.	DATE	DESCRIPTION	RECONSTRUCTION OF NE STEPHENS ST. DOUGLAS COUNTY RD. #388 M.P. 13.4 TO M.P. 14.6	
1	04/17/2003		ROBERT G. PAUL, P.E. DIRECTOR	
2	06/03/2003		JUNE 2003 SHEET 1	

TYPICAL SECTIONS & DETAILS



REVISIONS			DOUGLAS COUNTY		
NO.	DATE	DESCRIPTION	DEPARTMENT OF PUBLIC WORKS		
1	06/07/2003		RECONSTRUCTION OF		
			NE STEPHENS ST.		
			DOUGLAS COUNTY RD. #388		
			M.P. 13.4 TO M.P. 14.6		
339			ROBERT G. PAUL, P. E.		
			DIRECTOR		
			JUNE 2003		
			SHEET 2		

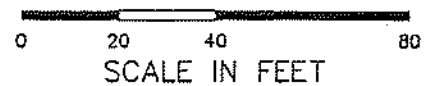


WATERLINE NOTES

- ① INSTALL: *SL 28145*
1 - 30" X 12" TAPPING SLEEVE
1-12" GATE VALVE (FLG X MJ)
FLG ISOLATING KIT (FULL FACE GASKET)
THRUST BLOCK PER DRAWING #102
(SEE TIE-IN DETAIL 1/10A)
- ② INSTALL TEMP. BLOW-OFF FOR
DISINFECTION AND TESTING
- ③ INSTALL 12" X 90'± DUCTILE IRON
WATERLINE
- ④ INSTALL PERMANENT 2" BLOW-OFF
ASSEMBLY CITY STD. DWG. #104
12" INV. = 576.50 @ BLOW-OFF

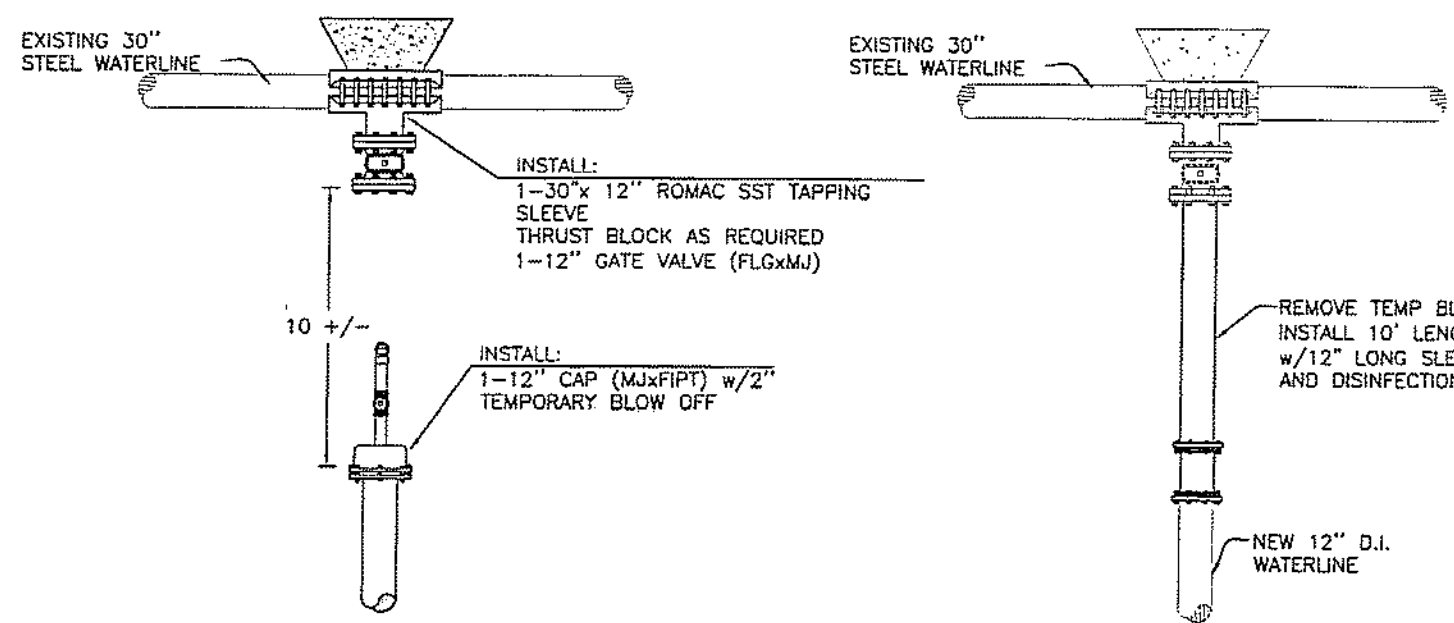
GENERAL NOTES

1. ALL MJ JOINTS SHALL USE RESTRAINED
JOINTS, MEGA-LUG OR APPROVED EQUAL
2. ALL EXTG. PIPES SHALL BE POTHOLED TO
DETERMINE DEPTHS AND ALIGNMENTS PRIOR
TO INSTALLATION OF NEW WATER MAINS
3. WATER MAINS TO BE CHLORINATED AND
PRESSURE TESTED PER SPECIFICATIONS.
TIE-IN PIPE AND FITTINGS SHALL BE
SWABBED W/CHLORINE SOLUTION AND
VISUALLY INSPECTED. NO LEAKAGE ALLOWED.
4. CONTRACTOR TO POTHOLE AND VERIFY
OUTSIDE DIAMETER OF 30" STEEL LINE PRIOR
TO ORDERING TAPPING SLEEVE.
5. ALL WATER FACILITY WORK SHALL
COMFORM TO CITY OF ROSEBURG WATER
SYSTEM SPECIFICATIONS AND MATERIAL
REQUIREMENTS



ATTENTION: Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0010 through OAR 952-001-0090. You may obtain a copy of the rules by calling the Oregon Notification Center at 1-800-332-2344.

REVISIONS 04/16/2003			DOUGLAS COUNTY DEPARTMENT OF PUBLIC WORKS RECONSTRUCTION OF NE STEPHENS ST. DOUGLAS COUNTY RD. #388 M. P. 13.4 TO M. P. 14.6	
DESIGN	CHECK	REVIEW	DIRECTOR	SHEET NO.
SPB			ROBERT G. PAUL, P. E.	JUNE 2003
DESIGN APPROVAL			DIRECTOR APPROVAL	DATE



STEP ONE

STEP TWO

DETAIL
1/10A

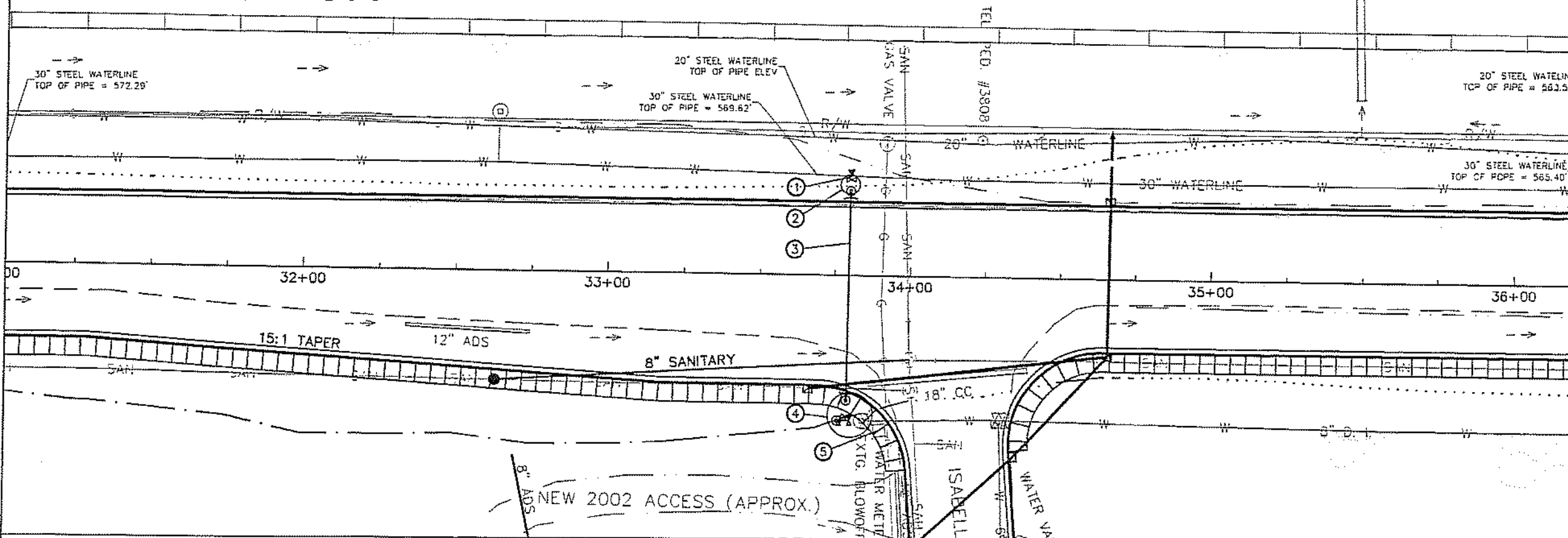
TIE IN DETAIL

27-06-01AD-00200
SHORT, LANCE C
INST. #PP
2000-0058

27-06-01AD-00500
DICKENS, JOANN
INST. #86-11748

27-06-G1AD-00400
DICKENS, JOANN
INST. #86-11748

CENTRAL OREGON & PACIFIC RAILROAD

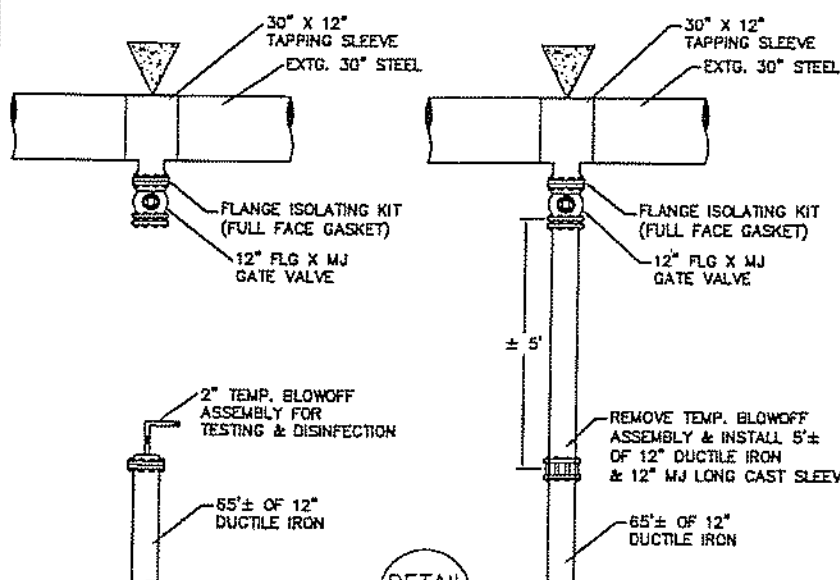


WATERLINE NOTES

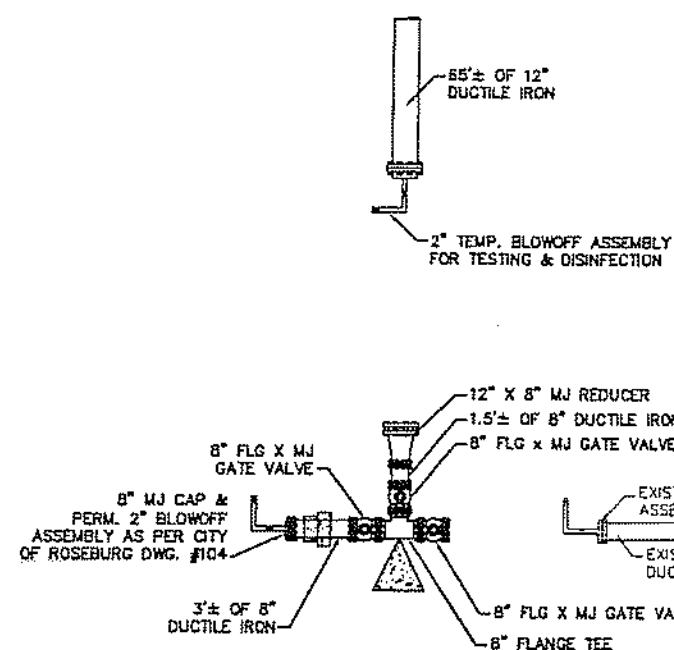
1. INSTALL 30" X 12" TAPPING SLEEVE 12" GATE VALVE, FLG X MJ FLG ISOLATING KIT (FULL FACE GASKET) THRUST BLOCK
2. INSTALL TEMP. BLOWOFF FOR TESTING AND DISINFECTING. SEE DETAIL 1/11A FOR TIE-IN DETAILS
3. INSTALL 12" X ±65' D. I. WATERLINE
4. INSTALL TEMP. BLOWOFF FOR TESTING AND DISINFECTING. SEE DETAIL 2/11A FOR TIE-IN DETAILS
5. RELOCATE EXTG. SERVICE TO BACK OF SIDEWALK. TIE TO EXTG. CUSTOMER SERVICE LINE. (PER CITY STD. DWG. #108)

GENERAL NOTES

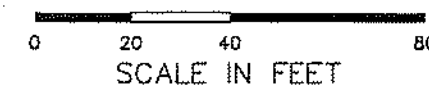
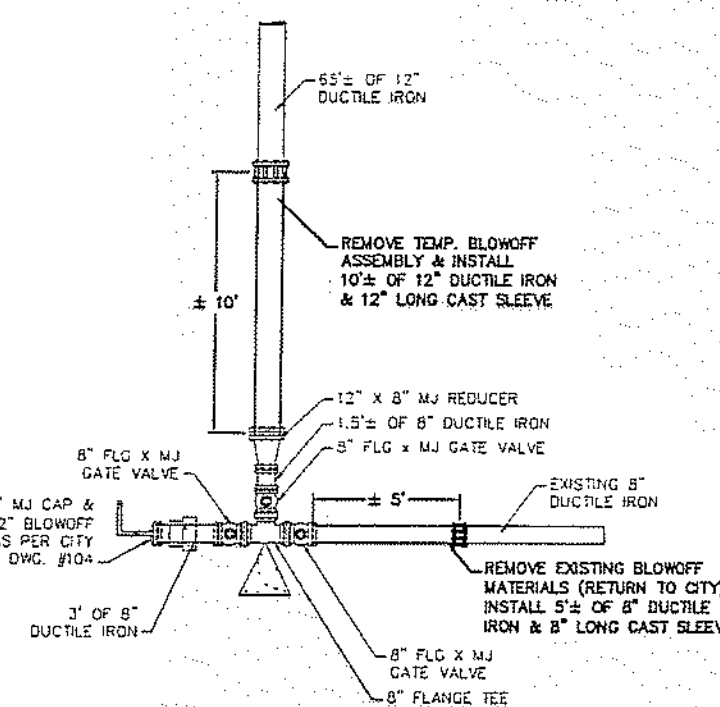
1. ALL MJ JOINTS SHALL USE RESTRAINED JOINTS, MEGA-LUG OR APPROVED EQUAL
2. ALL EXTG. PIPES SHALL BE POTHOLED TO DETERMINE DEPTHS AND ALIGNMENTS PRIOR TO INSTALLATION OF NEW WATER MAINS
3. WATER MAINS TO BE CHLORINATED AND PRESSURE TESTED PER SPECIFICATIONS. TIE-IN PIPE AND FITTINGS SHALL BE SWABBED W/CHLORINE SOLUTION AND VISUALLY INSPECTED. NO LEAKAGE ALLOWED.
4. CONTRACTOR TO POTHOLE AND VERIFY OUTSIDE DIAMETER OF 30" STEEL LINE PRIOR TO ORDERING TAPPING SLEEVE.
5. ALL WATER FACILITY WORK SHALL CONFORM TO CITY OF ROSEBURG WATER SYSTEM SPECIFICATIONS AND MATERIAL REQUIREMENTS



TIE IN WEST ISABELLE
NTS

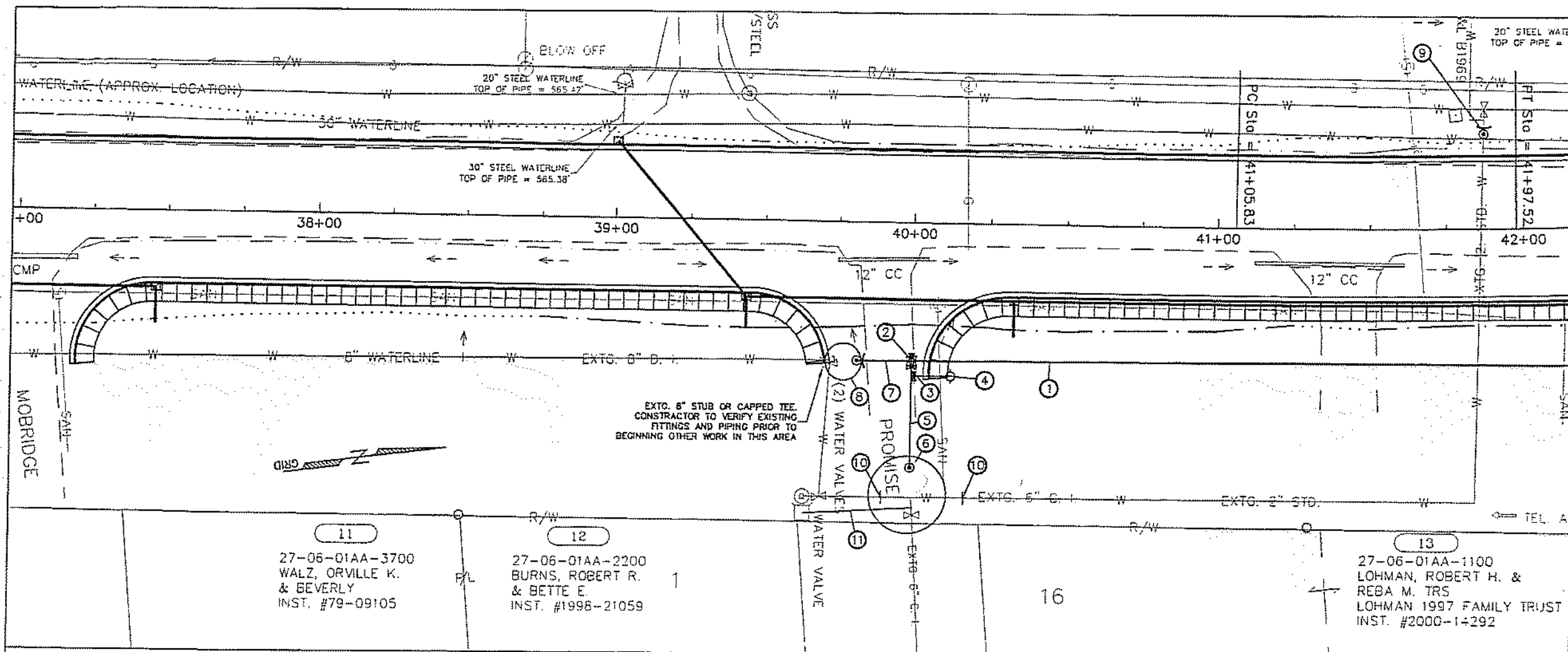


TIE IN EAST ISABELLE
NTS



ATTENTION: Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. These rules are set forth in OAR 952-001-0010 through OAR 952-001-0090. You may obtain a copy of the rules by calling the Oregon Notification Center at 1-800-332-2344.

REVISIONS		
01/14/2003		
DESIGN	CHECK	REVIEW
SPG		
DIRECTOR APPROVAL	DIRECTOR APPROVAL	DIRECTOR APPROVAL
DOUGLAS COUNTY DEPARTMENT OF PUBLIC WORKS RECONSTRUCTION OF NE STEPHENS ST. DOUGLAS COUNTY RD. #388 M. P. 13.4 TO M. P. 14.6		
ROBERT C. PAUL, P. E.		
JUNE 2003 SHEET 11A		

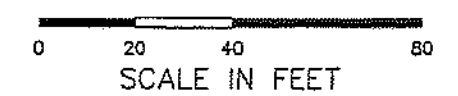


WATERLINE NOTES

- ① INSTALL 8" X 265' D. I. WATERLINE
- ② INSTALL 8" X 6" FLG TEE
(2) 8" FLG X MJ GATE VALVES
(1) 6" FLG X MJ GATE VALVE
THRUST BLOCK
- ③ INSTALL 6" X 4' D. I. WATERLINE
- ④ INSTALL 6" FIRE HYDRANT ASSEMBLY AS
PER CITY STD. DWG. #105
- ⑤ INSTALL 6" X 35' D. I. WATERLINE
- ⑥ INSTALL TEMP BLOWOFF. SEE DETAIL
1/12A FOR TIE-IN
- ⑦ INSTALL 8" X 18' D. I. WATERLINE
- ⑧ INSTALL 2" TEMP. BLOWOFF. SEE DETAIL
1/12A FOR TIE-IN
- ⑨ INSTALL FITTINGS AND THRUST BLOCK TO
CONVERT TO 2" BLOWOFF ASSEMBLY
AFTER NEW MAIN TIED IN. LEAVE
ADEQUATE LENGTH TO MAINTAIN EXTG.
SERVICE WEST OF RAILROAD TRACKS
- ⑩ CUT AND PLUG 2" LINE TO BE
ABANDONED AFTER NEW MAIN TIE-IN
- ⑪ INSTALL WATER SERVICE PER CITY STD.
DWG. #108 (USE EXTG. METER)

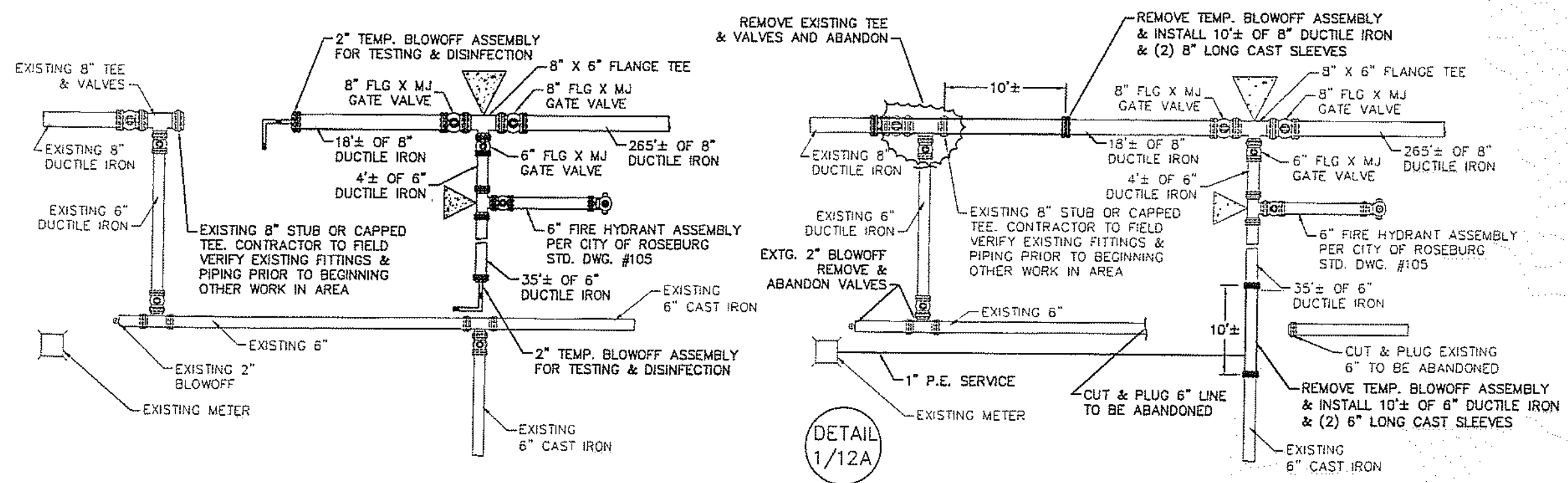
GENERAL NOTES

1. ALL MJ JOINTS SHALL USE RESTRAINED
JOINTS, MEGA-LUG OR APPROVED EQUAL
2. ALL EXTG. PIPES SHALL BE POTHOLED TO
DETERMINE DEPTHS AND ALIGNMENTS PRIOR
TO INSTALLATION OF NEW WATER MAINS
3. WATER MAINS TO BE CHLORINATED AND
PRESSURE TESTED PER SPECIFICATIONS.
TIE-IN PIPE AND FITTINGS SHALL BE
SWABBED W/CHLORINE SOLUTION AND
VISUALLY INSPECTED. NO LEAKAGE ALLOWED.
4. CONTRACTOR TO POTHOLE AND VERIFY
OUTSIDE DIAMETER OF 30" STEEL LINE PRIOR
TO ORDERING TAPPING SLEEVE.
5. ALL WATER FACILITY WORK SHALL
CONFORM TO CITY OF ROSEBURG WATER
SYSTEM SPECIFICATIONS AND MATERIAL
REQUIREMENTS



ATTENTION: Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0010 through OAR 952-001-0090. You may obtain a copy of the rules by calling the Oregon Notification Center at 1-800-332-2344.

REVISIONS			DOUGLAS COUNTY DEPARTMENT OF PUBLIC WORKS RECONSTRUCTION OF NE STEPHENS ST. DOUGLAS COUNTY RD. #388 M. P. 13.4 TO M. P. 14.6
NO.	DATE	DESCRIPTION	
1	04/14/2003		
2			
DESIGN	CHECK	REVIEW	DIRECTOR
SPS			ROBERT G. PAUL, P. E.
DESIGN APPROVAL			DATE JUNE 2003
			SHEET NO. 12A



DETAIL
1/12A
TIE IN PROMISE
NTS

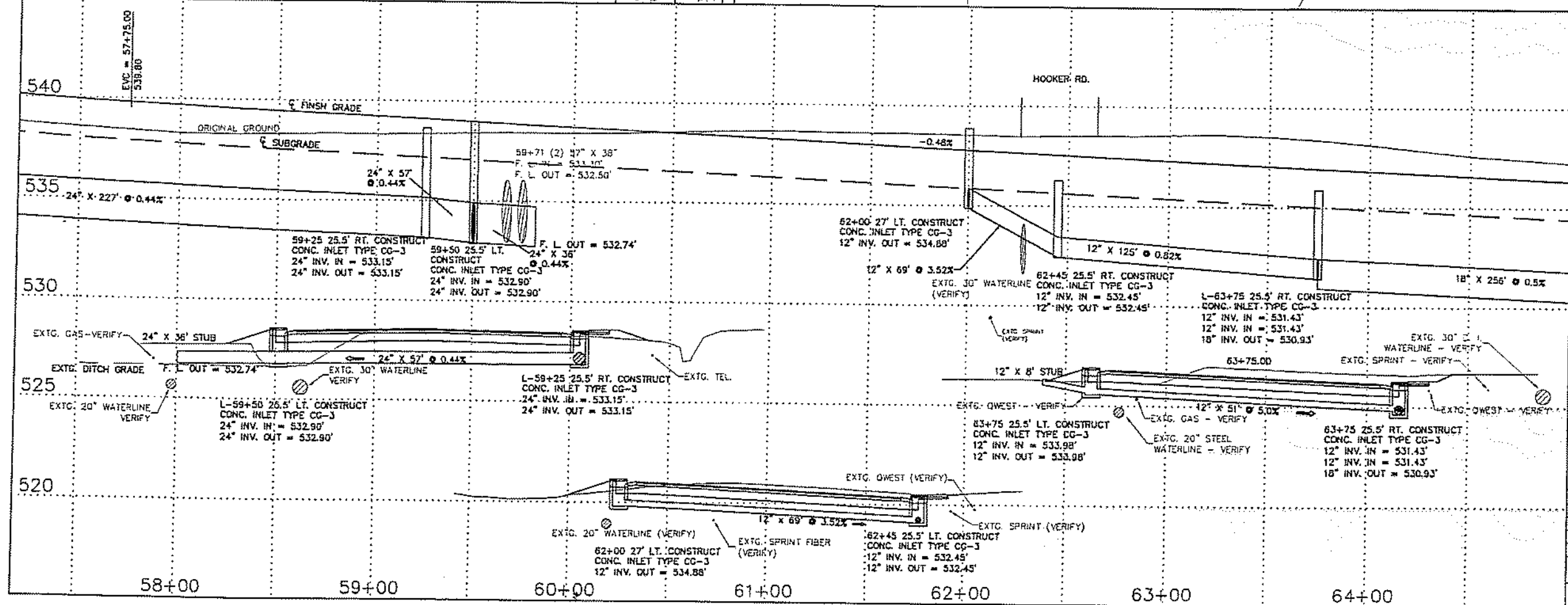
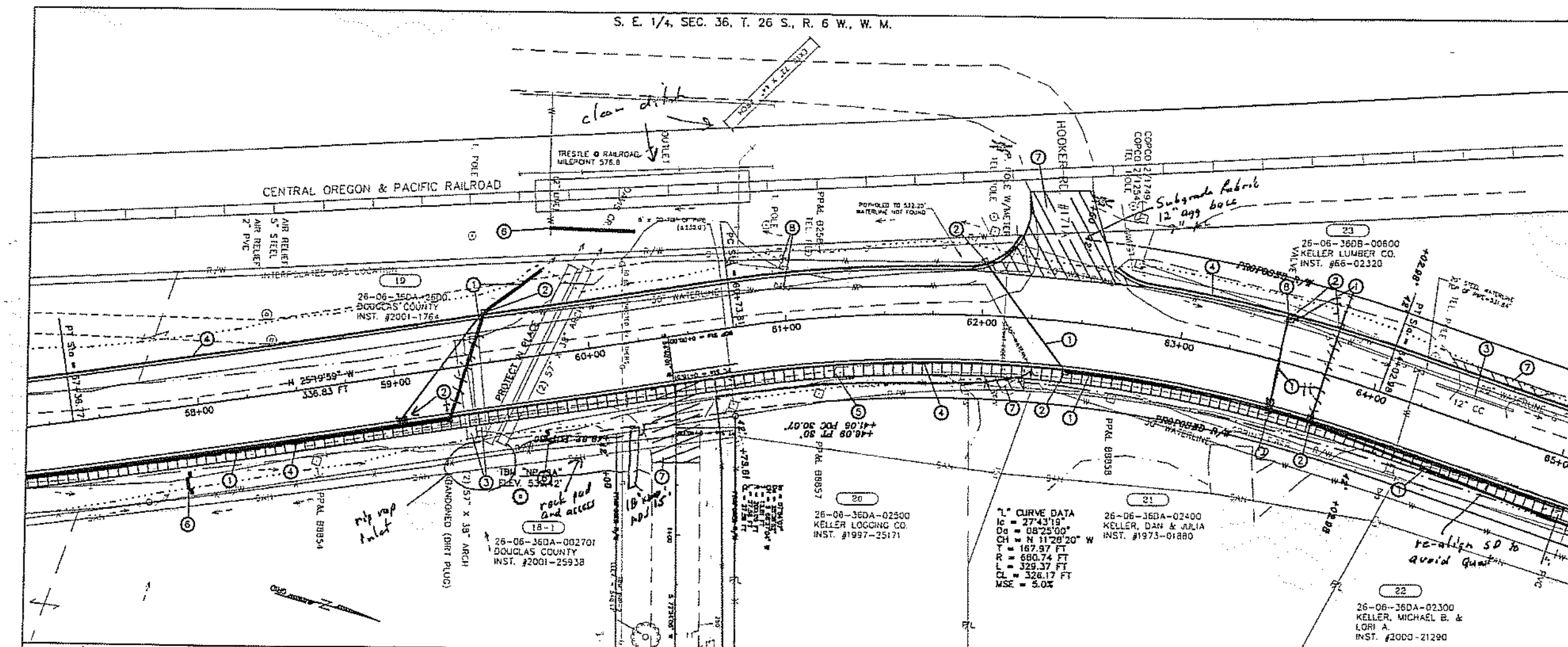
DOUGLAS COUNTY
DEPARTMENT OF PUBLIC WORKS
RECONSTRUCTION OF
NE STEPHENS ST.
DOUGLAS COUNTY RD. #388
M. P. 13.4 TO M. P. 14.6

ROBERT G. PAUL, P. E.

DIRECTOR

NOTES

- ① INSTALL CULVERT PIPE:
 57+00 25.5' RT. TO 59+25 25.5' RT. 24" X 22'
 59+25 25.5' RT. TO 59+50 25.5' LT. 24" X 36'
 59+50 25.5' LT. TO 59+81.5 42.5' LT. 24" X 36'
 62+00 27' LT. TO 62+45 25.5' RT. 12" X 69'
 62+45 25.5' RT. TO 63+75 25.5' RT. 12" X 125'
 63+75 33.5' LT. TO 63+75 25.5' LT. 12" X 8'
 63+75 25.5' LT. TO 63+75 25.5' RT. 12" X 51'
 63+75 25.5' RT. TO 66+32 37.5' RT. 18" X 256'
- ② CONSTRUCT CONCRETE INLET TYPE CG-3:
 59+25 25.5' RT. 44x44 R/W
 59+50 25.5' LT. 44x44 R/W
 62+00 27' LT.
 62+45 25.5' RT.
 63+75 25.5' RT.
 63+75 25.5' LT.
- ③ REMOVE EXTG. CULVERTS AS SHOWN
- ④ CONSTRUCT MODIFIED ODOT TYPE "A" CURB & GUTTER 12,871 L.F. IN ALL
- ⑤ CONSTRUCT 4" X 6' SIDEWALK 6237 L.F. IN ALL
- ⑥ INSTALL SEDIMENT BARRIER - 60 L.F.
- ⑦ CONSTRUCT A.C. APPROACH
 60+40 RT. - NONPROFIT CAMPUS NORTH ACCESS
 62+13 RT. - 20' DRIVEWAY
 62+36 LT. - HOOKER ROAD
 64+54 LT. - 25' DRIVEWAY
- ⑧ ADJUST VALVE BOXES (5)



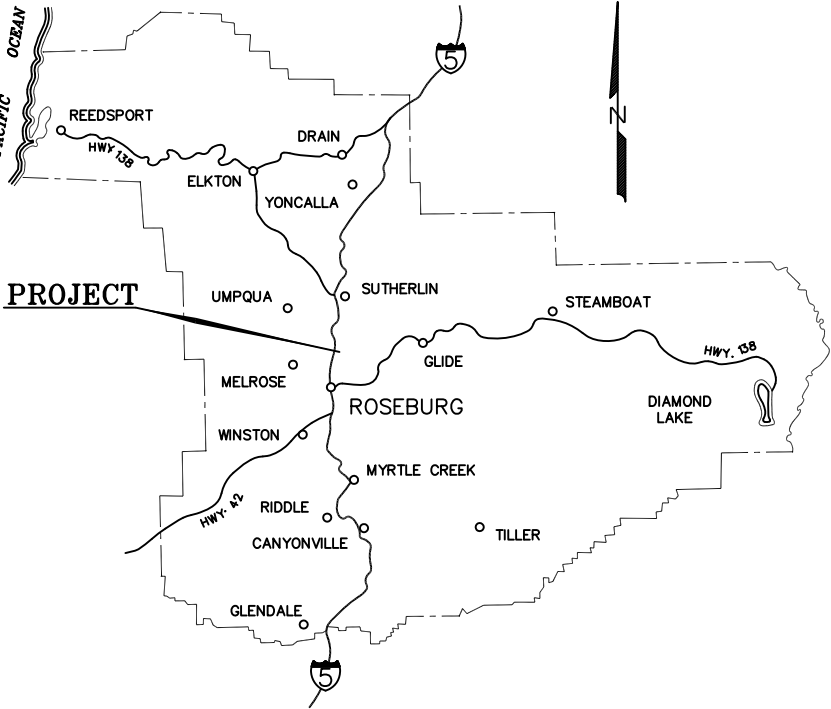
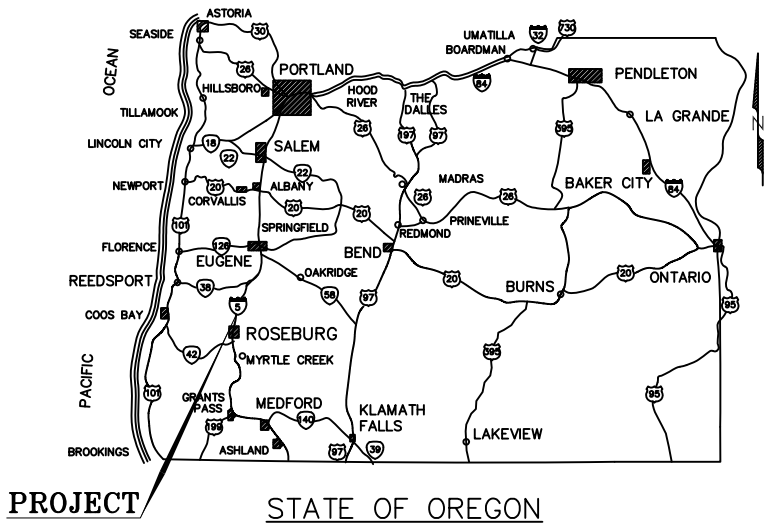
0 30 60 120
SCALE IN FEET

ATTENTION: Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0010 through OAR 952-001-0090. You may obtain a copy of the rules by calling the Oregon Notification Center at 1-800-332-2344.

SHEET 15.DWG

REVISIONS			DOUGLAS COUNTY DEPARTMENT OF PUBLIC WORKS	
NO.	DATE	DESCRIPTION		
1	04/07/2003		RECONSTRUCTION OF NE STEPHENS ST. DOUGLAS COUNTY RD. #388 M.P. 13.4 TO M.P. 14.6	
2				
3			ROBERT G. PAUL, P.E. DIRECTOR	
4				
5			JUNE 2003 SHEET 15	
6				

DOUGLAS COUNTY, OREGON
PLANS FOR CONSTRUCTION OF
NONPROFIT CAMPUS RD.
AND INFRASTRUCTURE
2003



VICINITY MAP
N.T.S.

DRAWING INDEX

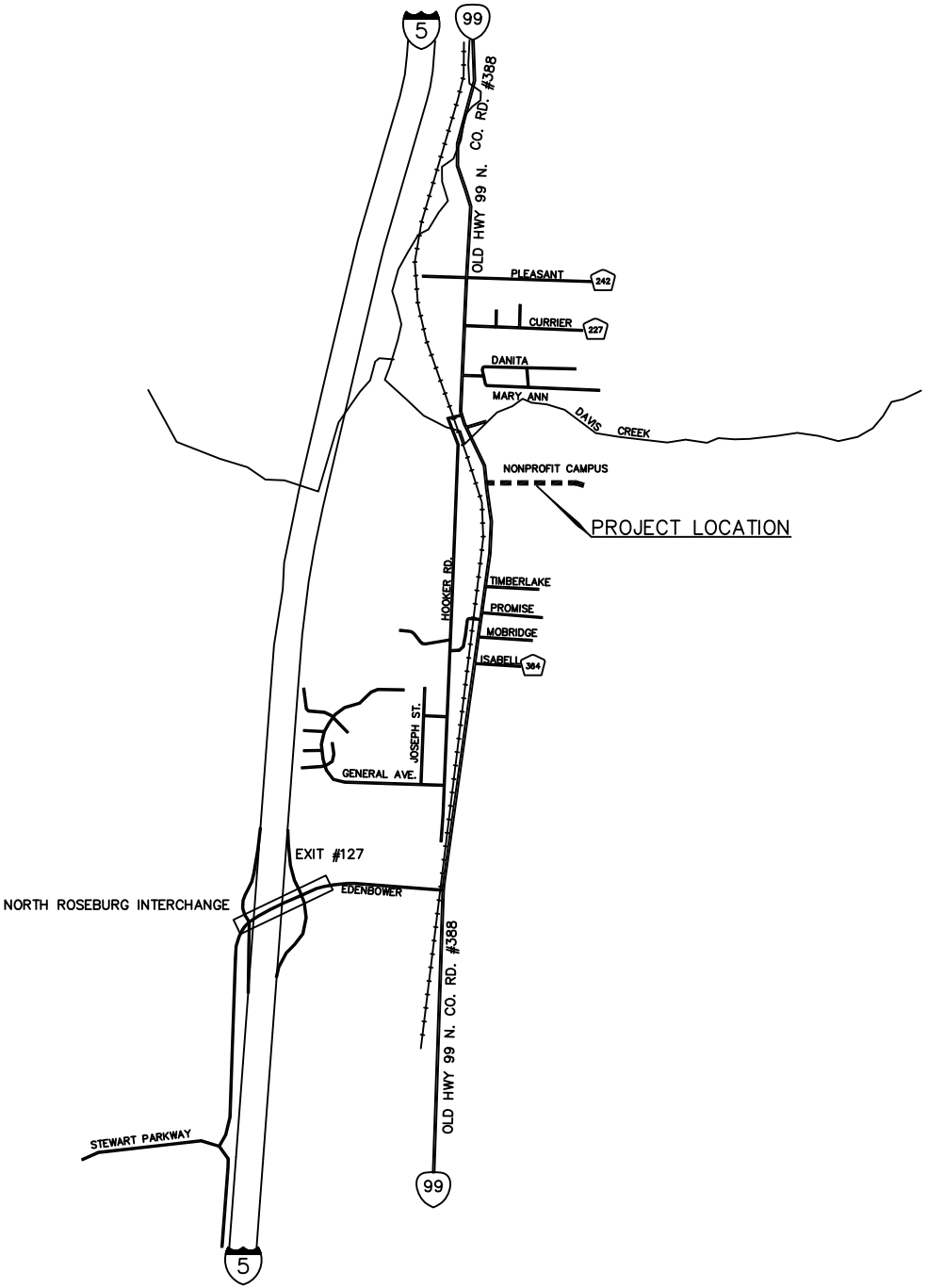
SHEET #	DRAWING
1	COVER
2-3	TYPICAL SECTIONS & DETAILS
4	PIPE DATA SHEET
5-6	PLAN & PROFILE
7-8	WATERLINE PLANS
9-10	SANITARY SEWER PLANS

OREGON STANDARD/DETAIL DRAWINGS

RD338	SANITARY SEWER MANHOLE
RD372	CONCRETE INLETS
RD364	CONCRETE INLETS
RD700	CURBS
RD750	SIDEWALK DRIVEWAYS (OPTION M)
RD755	SIDEWALK RAMP DETAILS
RD760	SIDEWALK RAMP PLACEMENT
RD900	TRAFFIC CONTROL PLANS
RD910	TRAFFIC CONTROL PLANS
TM100	TEMPORARY SIGNS

CITY OF ROSEBURG STANDARD DRAWING

#102	THRUST BLOCKING
#103	VALVE AND VALVE BOX ASSEMBLY
#104	2" BLOWOFF ASSEMBLY
#105	FIRE HYDRANT ASSEMBLY (THRUST BLOCKED)



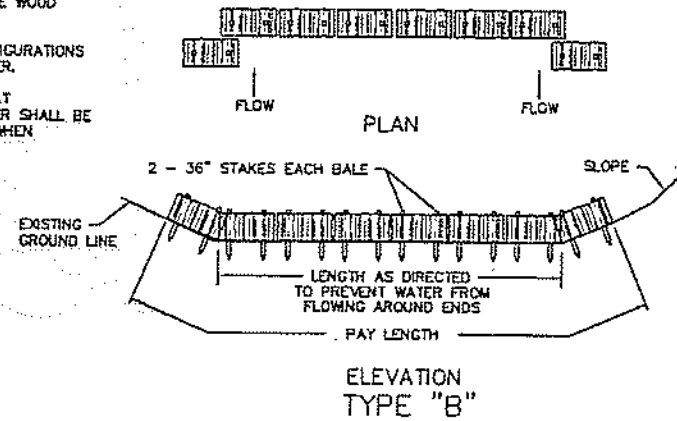
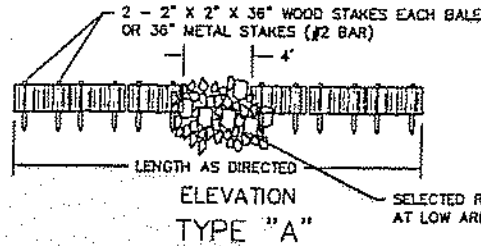
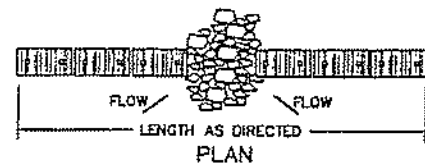
ATTENTION:
Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0010 through OAR 952-001-0090. You may obtain copies of the rules by calling the center at 1-800-332-2344.

REVISIONS			DOUGLAS COUNTY DEPARTMENT OF PUBLIC WORKS CONSTRUCTION OF NONPROFIT CAMPUS RD. COVER		
04/07/2003					
ASBUILT					
DESIGN			DIRECTOR		
CHECK			ROBERT G. PAUL, P. E.		
REVIEW			DRAWING NO.		
GPG			SHEET 1		
DIVISION APPROVAL			DATE		
			JUNE 2003		

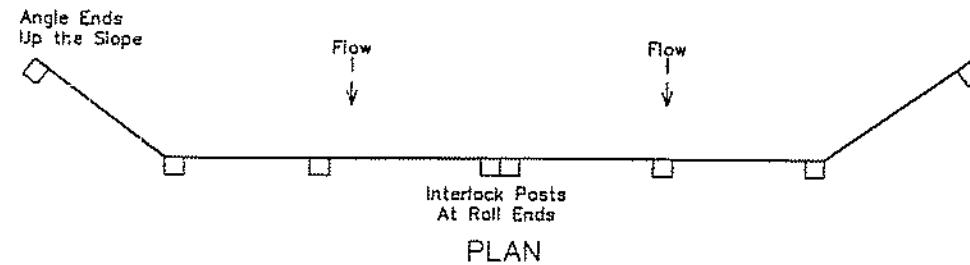
TYPICAL SECTIONS & DETAILS

NOTES:

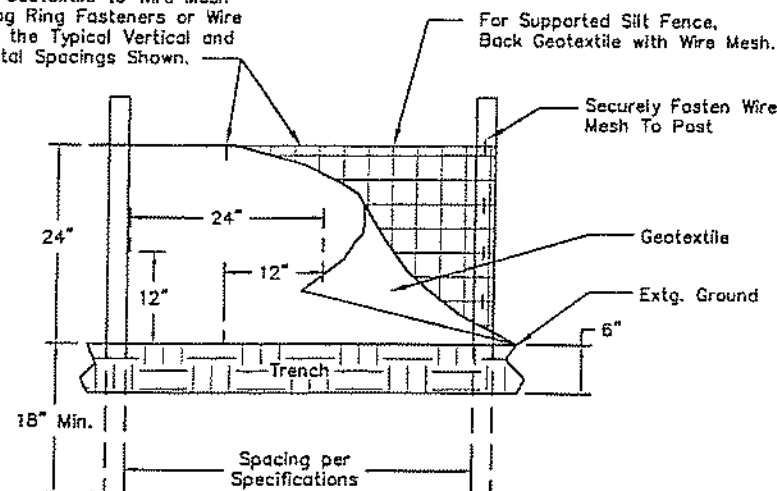
1. EMBED BALES 4" TO 6" INTO GROUND.
2. IN PLACES WHERE BALES WILL BE ALLOWED TO REMAIN IN PLACE WOOD STAKES SHALL BE USED.
3. SPACING AND OTHER CONFIGURATIONS AS DIRECTED BY THE ENGINEER.
4. SEDIMENT DEBRIS ETC. THAT ACCUMULATES AT THE BARRIER SHALL BE REMOVED AND DISPOSED OF WHEN DIRECTED BY THE ENGINEER.



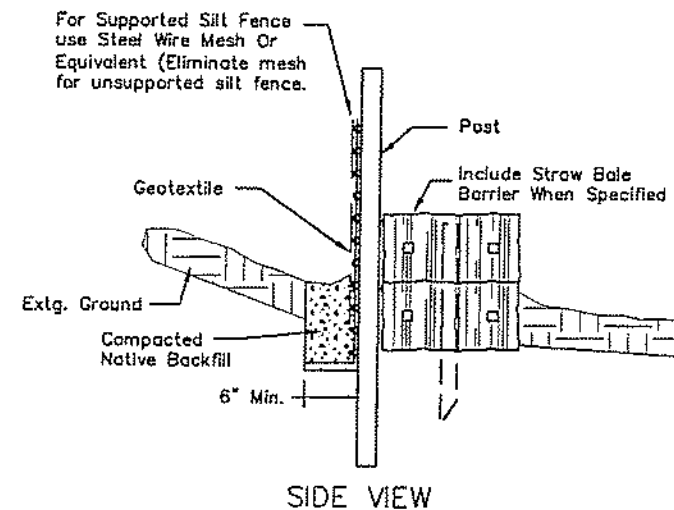
(CONSTRUCT AT LOCATIONS AS DIRECTED)
STRAW BALE SEDIMENT BARRIERS



Attach Geotextile to Wire Mesh with Hog Ring Fasteners or Wire Ties at the Typical Vertical and Horizontal Spacings Shown.

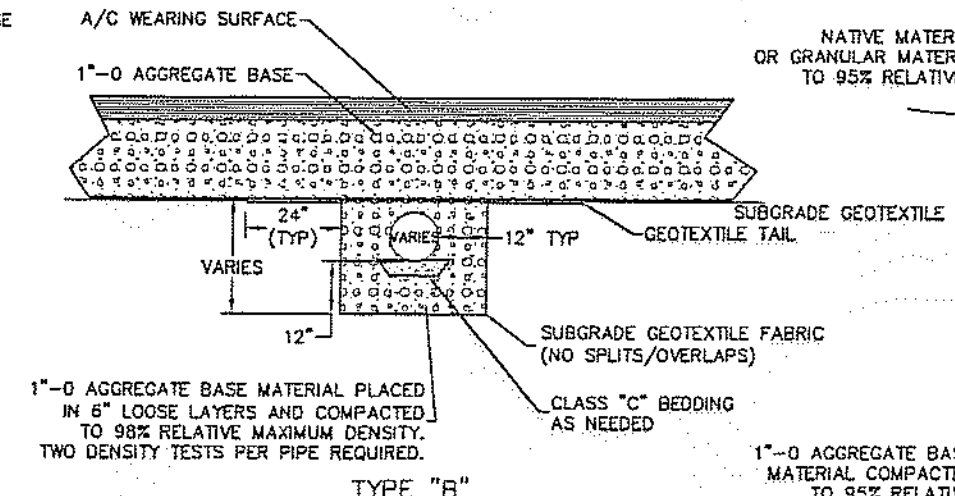
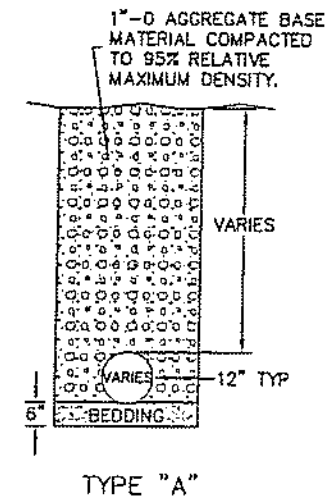


Install Along Contours As Follows:	
SLOPE	MAXIMUM SPACING
Less Than 10%	300'
Less Than 15%	150'
Less Than 20%	100'
Less Than 30%	50'
Greater Than 30%	25'

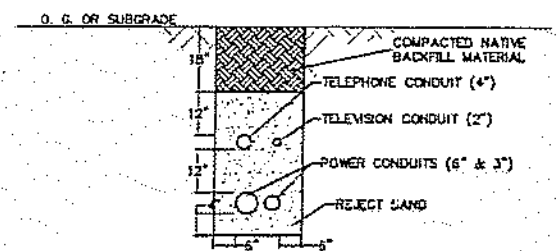
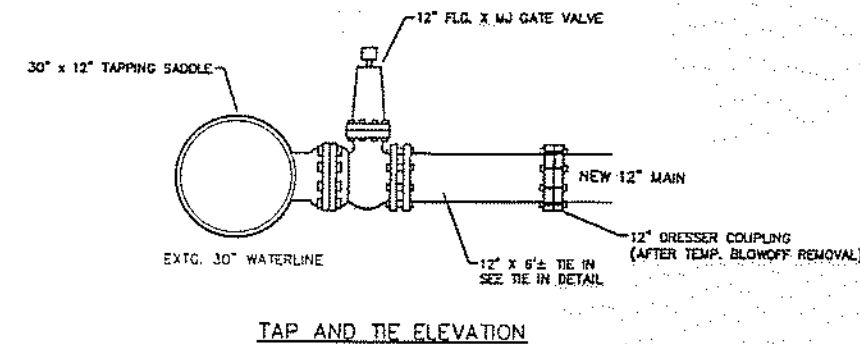
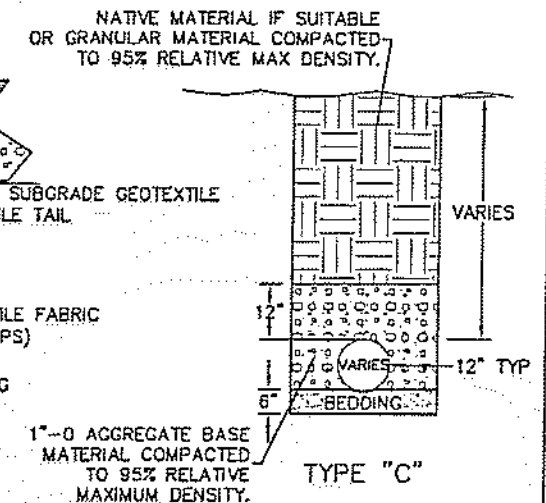


FIELD FABRICATED SILT FENCE
(SUPPORTED AND UNSUPPORTED)

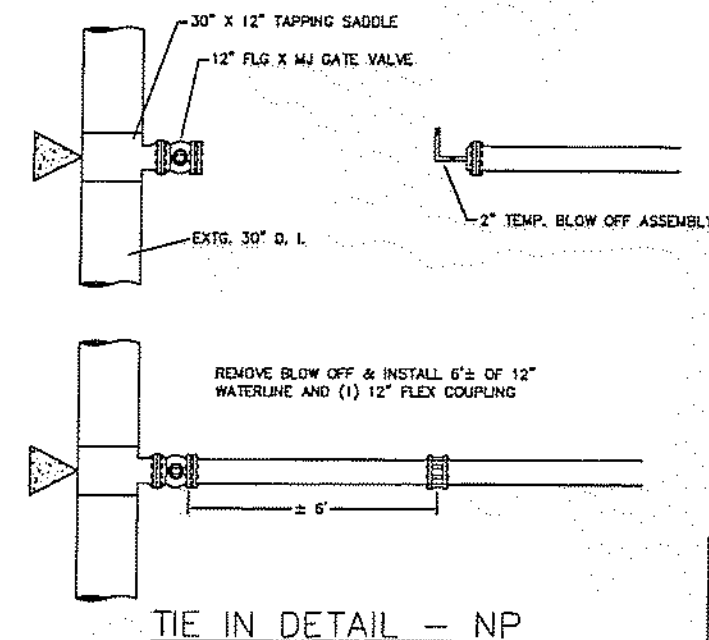
siltfence.dwg



TRENCH BACKFILL DETAILS



UTILBFD.DWG N.T.S.



REVISIONS			DOUGLAS COUNTY DEPARTMENT OF PUBLIC WORKS	
DATE	DESCRIPTION	BY	CONSTRUCTION OF NONPROFIT CAMPUS RD. TYPICALS & DETAILS	
04/14/2003			ROBERT G. PAUL, P. E.	
DESIGN	CHECK	REVIEW	DIRECTOR APPROVAL	DIRECTOR
04/14/2003			DATE	DATE
			JUNE 2003	SHEET 3

18-1

26-06-360A-002701
DOUGLAS COUNTY
INST. #2001-25938

18-2

26-06-3600-00102
OLD SCHOOL OFFICES INC.
INST. #2601-22078

CENTRAL OREGON & PACIFIC RAILROAD

26-06-3600-200
DOUGLAS COUNTY
INST. #2001-1764

INTERPOLATED 20" WATERLINE LOCATION

INTERPOLATED 30" WATERLINE LOCATION

NE STEPHENS RD. #388

PROPOSED 10' UTILITY EASEMENT

PROPOSED R/W

NONPROFIT CAMPUS RD.

11+00 12+00 13+00 14+00 15+00 16+00

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- ① INSTALL 30" TAPPING SADDLE
12" FLG. X MJ GATE VALVE
- ② INSTALL 12" X 100' D. I. WATERLINE
- ③ INSTALL 12" X 365' D. I. WATERLINE
- ④ INSTALL 12" X 8" FLG. X FLG. TEE
- ⑤ INSTALL 12" FLG. X MJ GATE VALVE AND
VALVE BOX ASSEMBLY
ROSEBURG STD. DWG. #103
- ⑥ INSTALL 8" FLG. X MJ GATE VALVE AND
VALVE BOX ASSEMBLY
ROSEBURG STD. DWG. #103
- ⑦ INSTALL 12" X 220' D. I. WATERLINE
- ⑧ INSTALL 8" X 40' D. I. WATERLINE
- ⑨ INSTALL TYPICAL FIRE HYDRANT INSTALLATION
(THRUST BLOCKED) ROSEBURG STD. DWG. #105
- ⑩ INSTALL 8" X 12' D. I. WATERLINE W/ TYPICAL
TEMP. 2" BLOWOFF ASSEMBLY
ROSEBURG STD. DWG. #104
- ⑪ INSTALL TYPICAL TEMP. 2" BLOWOFF ASSEMBLY
ROSEBURG STD. DWG. #104
- ⑫ INSTALL 12" X 6' D. I. TIE IN AFTER ALL
DISINFECTING AND TESTING IS APPROVED.
(SEE TIE IN DETAILS SHEET #3)

ATTENTION: Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0010 through OAR 952-001-0090. You may obtain a copy of the rules by calling the Oregon Notification Center at 1-800-332-2344.

REVISIONS			BOUGLAS COUNTY		
04/01/2003			DEPARTMENT OF PUBLIC WORKS		
			CONSTRUCTION OF		
			NONPROFIT CAMPUS RD.		
			WATERLINE		
DESIGN	DRAWN	REVIEW	ROBERT C. PAUL, P. E.		
SP9			DIRECTOR		
ENGINEER APPROVAL			DATE		
			JUNE 2003		
			SHEET 7		
			DRAWING NO.		

S. E 1/4, SECTION 36, T. 26 S., R. 6 W., W. M.

18
26-05-350A-002701
DOUGLAS COUNTY
INST. #2001-25938

18-2
26-05-360D-00102
OLD SCHOOL OFFICES INC.
INST. #2001-22078

IC = 52'34"10"
DA = 28'38"52"
CH = S 80°04'45" E
T = 98.78 FT
R = 200.00 FT
CL = 163.50 FT
L = 177.13 FT

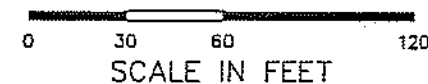
SLOPE AND UTILITY EASEMENT

YBM #NP-4
ELEV. = 586.54'

WATERLINE NOTES

1. INSTALL 12" X 220' D. I. WATERLINE
2. INSTALL 12" X 8" FLG X FLG TEE
3. INSTALL 12" FLG. X MJ GATE VALVE AND VALVE BOX ASSEMBLY ROSEBURG STD. DWG. #103
4. INSTALL 8" FLG. X MJ GATE VALVE AND VALVE BOX ASSEMBLY ROSEBURG STD. DWG. #103
5. INSTALL 12" X 10' D. I. WATERLINE
6. INSTALL 8" X 52' D. I. WATERLINE
7. INSTALL TYPICAL TEMP. 2" BLOWOFF ASSEMBLY ROSEBURG STD. DWG. #104

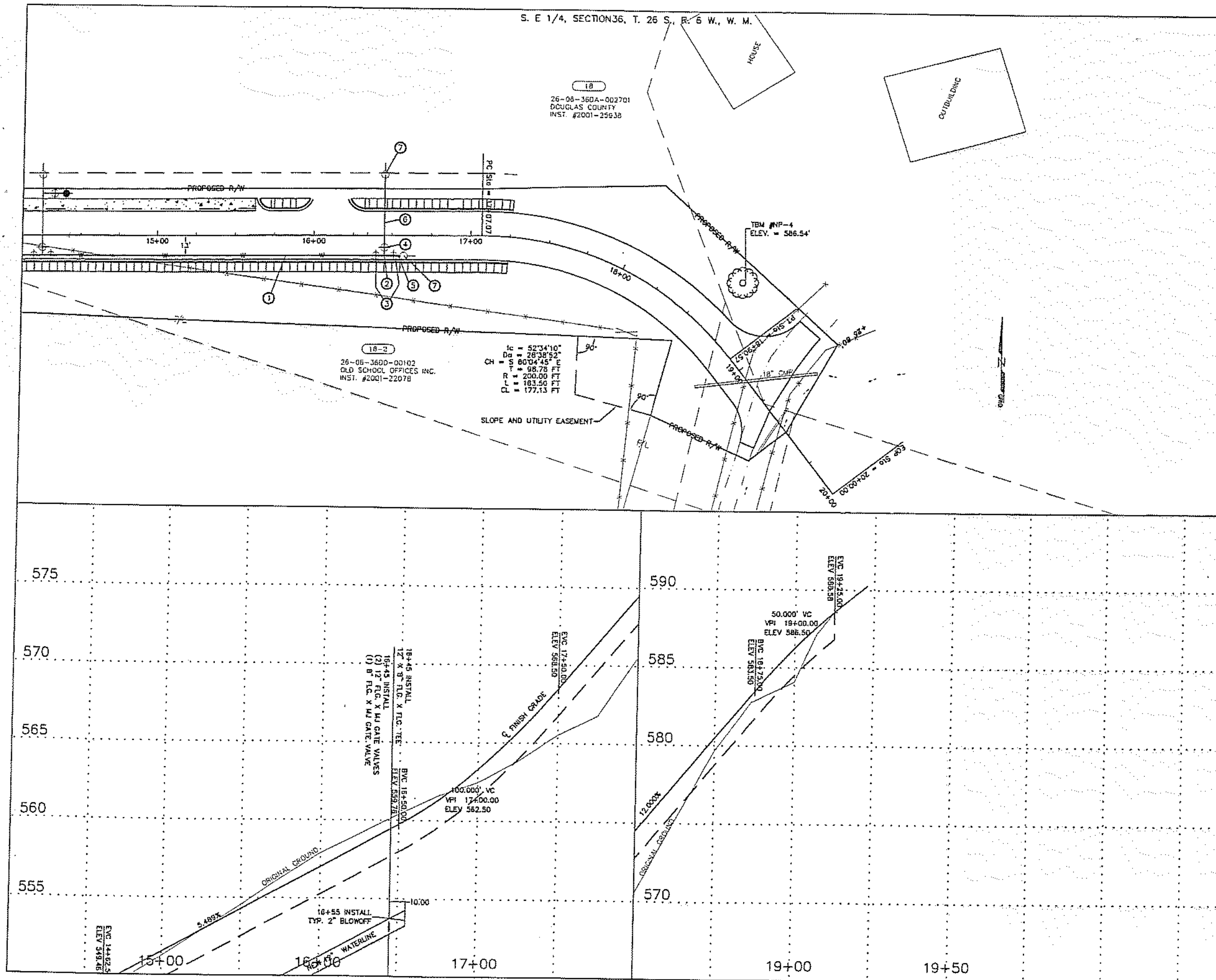
GENERAL NOTE:
ALL WORK AND MATERIALS TO CONFORM TO
CITY OF ROSEBURG STANDARDS



ATTENTION: Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0010 through OAR 952-001-0090. You may obtain a copy of the rules by calling the Oregon Notification Center at 1-800-332-2344.

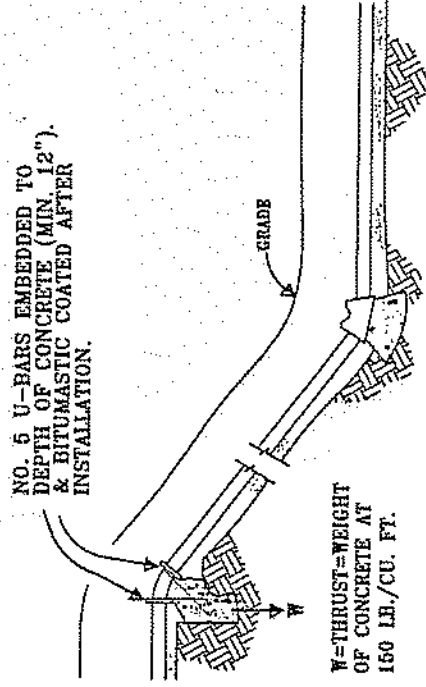
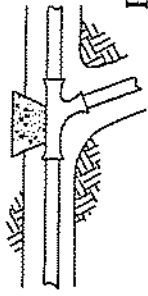
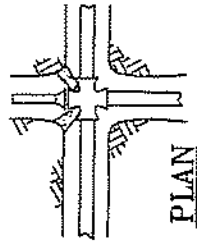
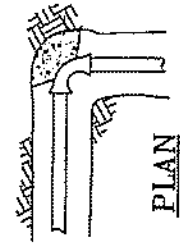
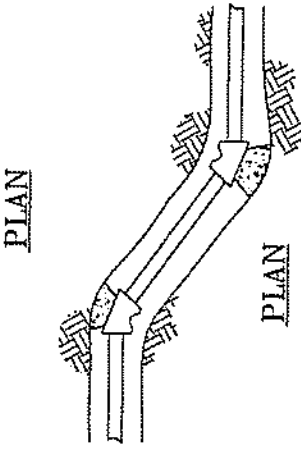
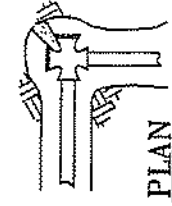
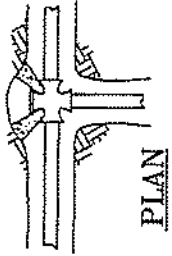
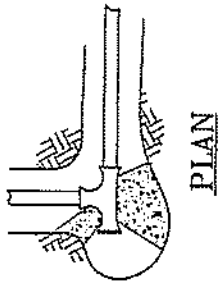
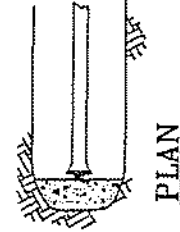
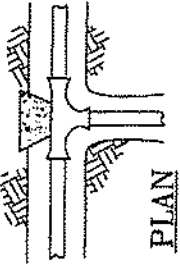
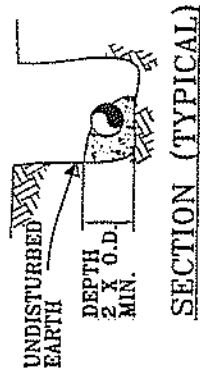
SHEET-SHOWED.DWG

REVISIONS			DOUGLAS COUNTY DEPARTMENT OF PUBLIC WORKS	
NO.	DATE	REVISION		
1	04/07/2003		CONSTRUCTION OF NONPROFIT CAMPUS RD. WATERLINE	
DESIGN	DRAWN	REVIEW		
399			ROBERT G. PAUL, P. E. DIRECTOR	
DESIGN APPROVAL	DIRECTOR APPROVAL	DATE		
		JUNE 2003	SHEET 8	



THRUST BLOCKING

HORIZONTAL BLOCKING



PROFILE

TABLE A

THRUST AT FITTINGS IN POUNDS AT 150 POUNDS PER SQUARE INCH OF WATER PRESSURE

PIPE SIZE	TABLE A				TABLE B	
	PLUG OR TEE	90° BEND	45° BEND	22 1/2° BEND	SOIL TYPE	SAFE BEARING LOAD, LB./SQ. FT.
4"	2780	3920	2130	1080	MULCH, PEAT, ETC...	0
6"	5700	8060	4370	2210	CLAY	1000
8"	9870	13,950	7560	3830	SAND	2000
10"	16,130	22,800	12,360	6260	SAND & GRAVEL	3000
12"	22,970	32,460	17,580	8910	SAND & GRAVEL CEMENTED WITH CLAY	4000
					HARD SHALE	10,000

NOTES:

- THRUST BLOCKING SHALL BE PLACED BETWEEN UNDISTURBED EARTH AND THE FITTING TO BE ANCHORED. THE MINIMUM BEARING AREA AGAINST UNDISTURBED EARTH FOR THRUST BLOCKING SHALL BE CALCULATED BY DIVIDING THE THRUST (TABLE A) BY THE SAFE BEARING LOAD (TABLE B). EXAMPLE: A 6", 45° HORIZONTAL BEND WILL BE BLOCKED AGAINST CLAY. THE REQUIRED BLOCKING AREA AGAINST UNDISTURBED EARTH, $A = 4370 \text{ lb.} / 1000 \text{ lb./sq.ft.} = 4.37 \text{ sq. ft.}$
- ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2500 psi AT 28 DAYS.
- THRUST BLOCKING SHALL BE PLACED SO THAT THE PIPE AND FITTING JOINTS WILL BE ACCESSIBLE FOR REPAIRS. INSTALL 6 mil POLYETHYLENE SHEETING BETWEEN CONTACT POINTS OF CONCRETE AND FITTINGS.
- THRUST BLOCKING FOR PIPES LARGER THAN 12", PRESSURES GREATER THAN 150 psi OR OTHER SITUATIONS NOT SHOWN HERE ON SHALL BE AS DIRECTED BY THE ENGINEER.

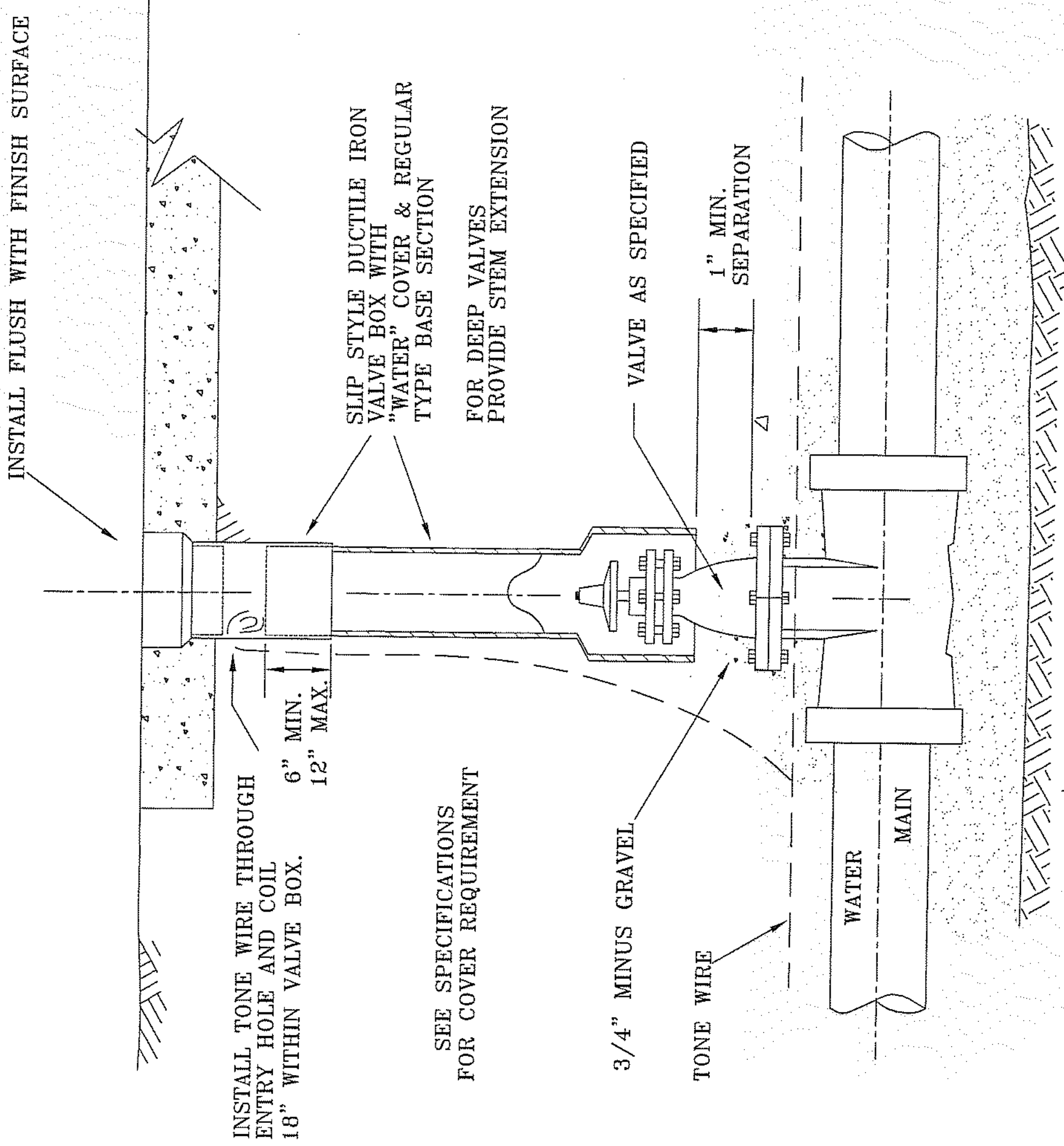
CITY OF ROSEBURG

WATER DEPARTMENT

DATE: 10/10/1983
REV: 5-11-1999

STANDARD 102
DWG. NO.

TYPICAL VALVE & VALVE BOX ASSEMBLY



NOTE: THIS VALVE BOX SHALL BE A RICH STYLE 931 DUCTILE IRON VALVE BOX OR APPROVED EQUAL.

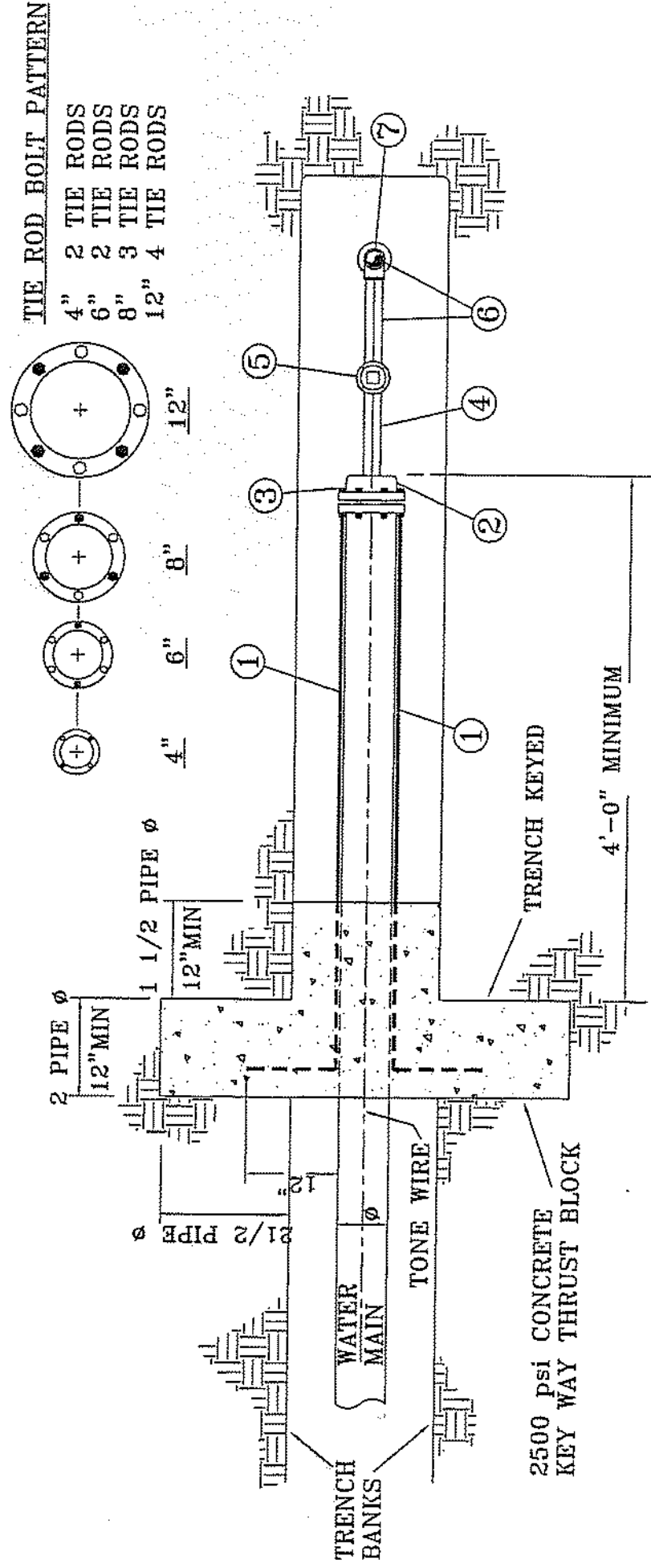
CITY OF ROSEBURG

WATER DEPARTMENT

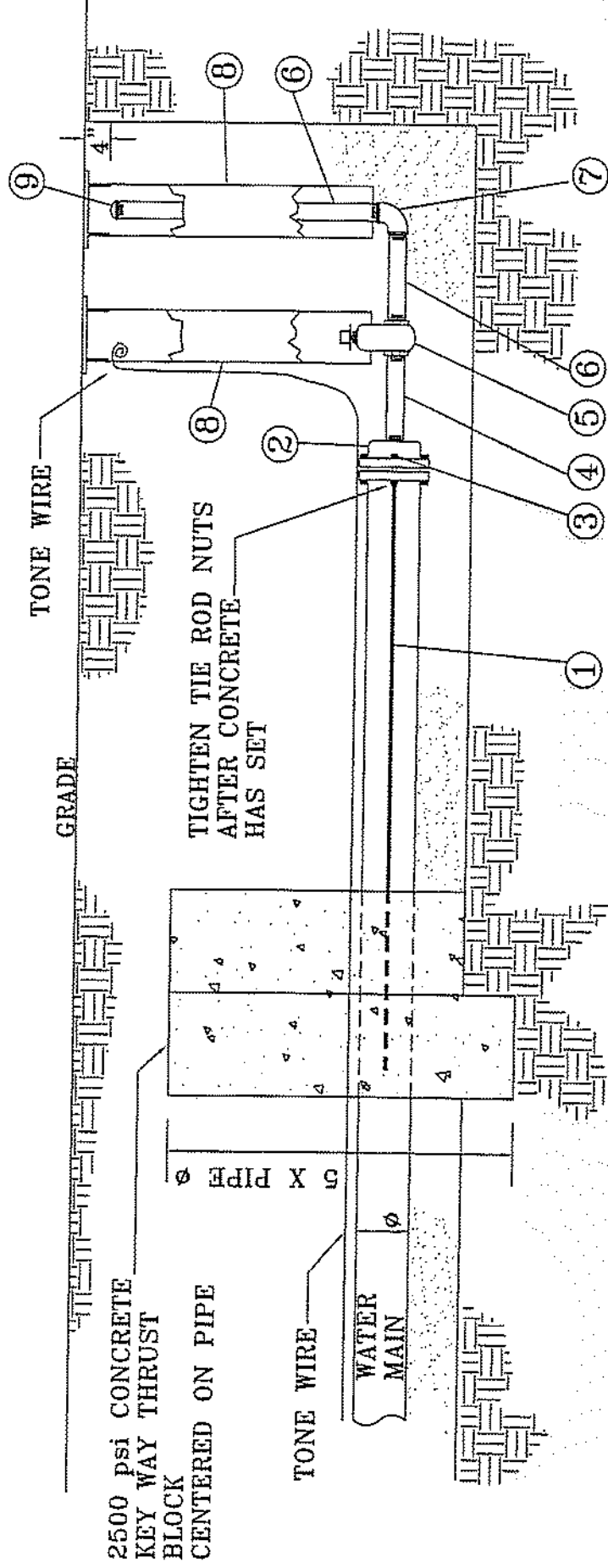
DATE: 10/13/1983
REV: 4/3/2001

STANDARD
DWG. NO. 103

TYPICAL 2" BLOWOFF ASSEMBLY



PLAN VIEW

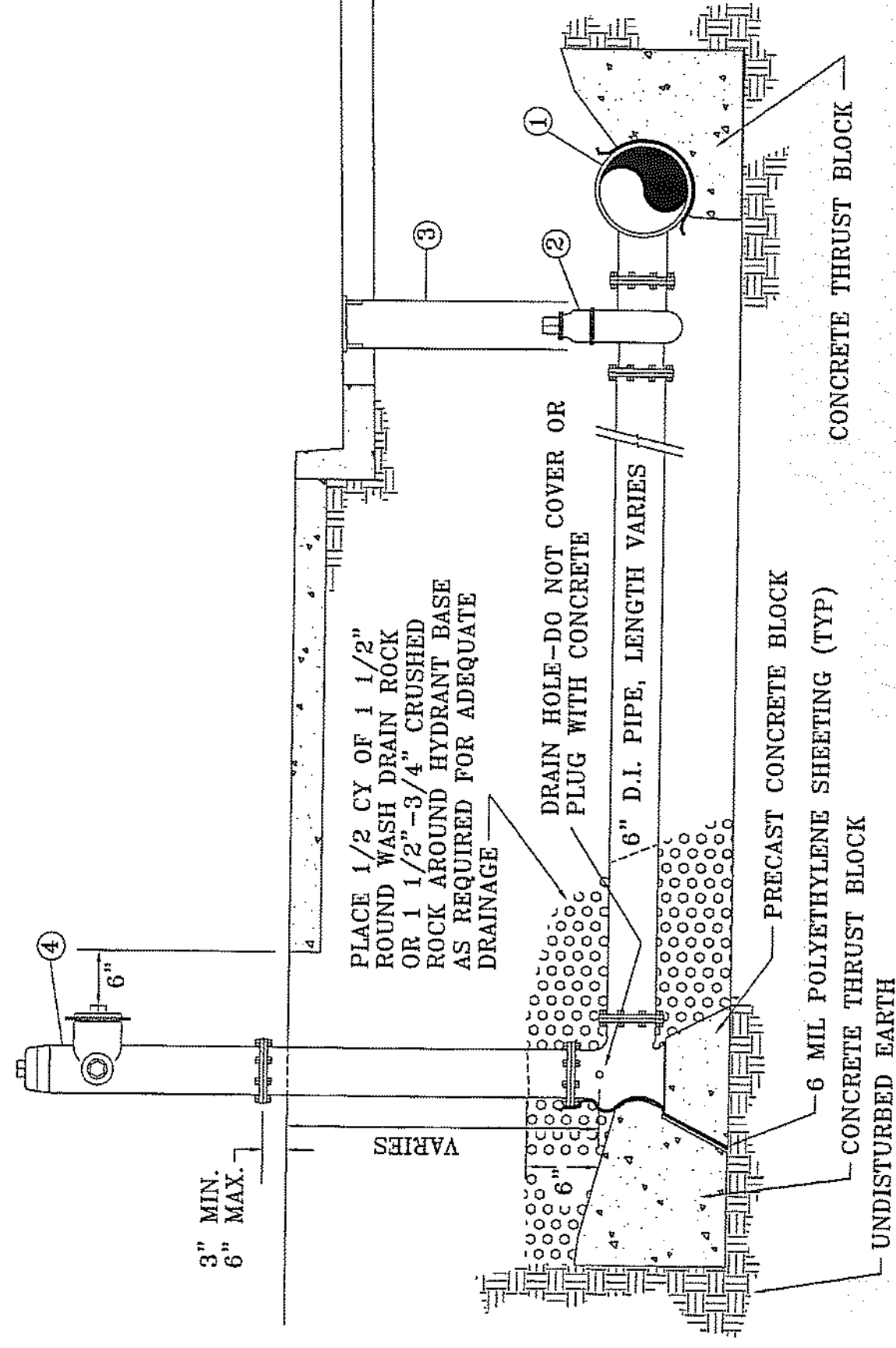


SIDE VIEW

LEGEND

- 1 3/4" ϕ STEEL TIE ROD, N.C. THD ONE END, BITUMASTIC COATED AFTER INSTALLATION
- 2 MAIN SIZE CAP WITH 2" I.P. THD OUTLET (MJ X FIPT)
- 3 STAR "SUPERSTAR TIEBOLT" AND "SUPERSTAR TIENUT" (OPTIONAL)
- 4 2" GALV. IRON PIPE NIPPLE, BITUMASTIC COATED AFTER INSTALLATION OR BRASS PIPE NIPPLE
- 5 2" GATE VALVE (FIPT) WITH 2" SQUARE OPERATING NUT
- 6 2" GALV. IRON PIPE, LENGTH AS REQUIRED
- 7 2" GALV. 90° ELBOW (FIPT)
- 8 6" STANDARD VALVE BOX WITH LID
- 9 2" CAP, HAND TIGHTEN ONLY

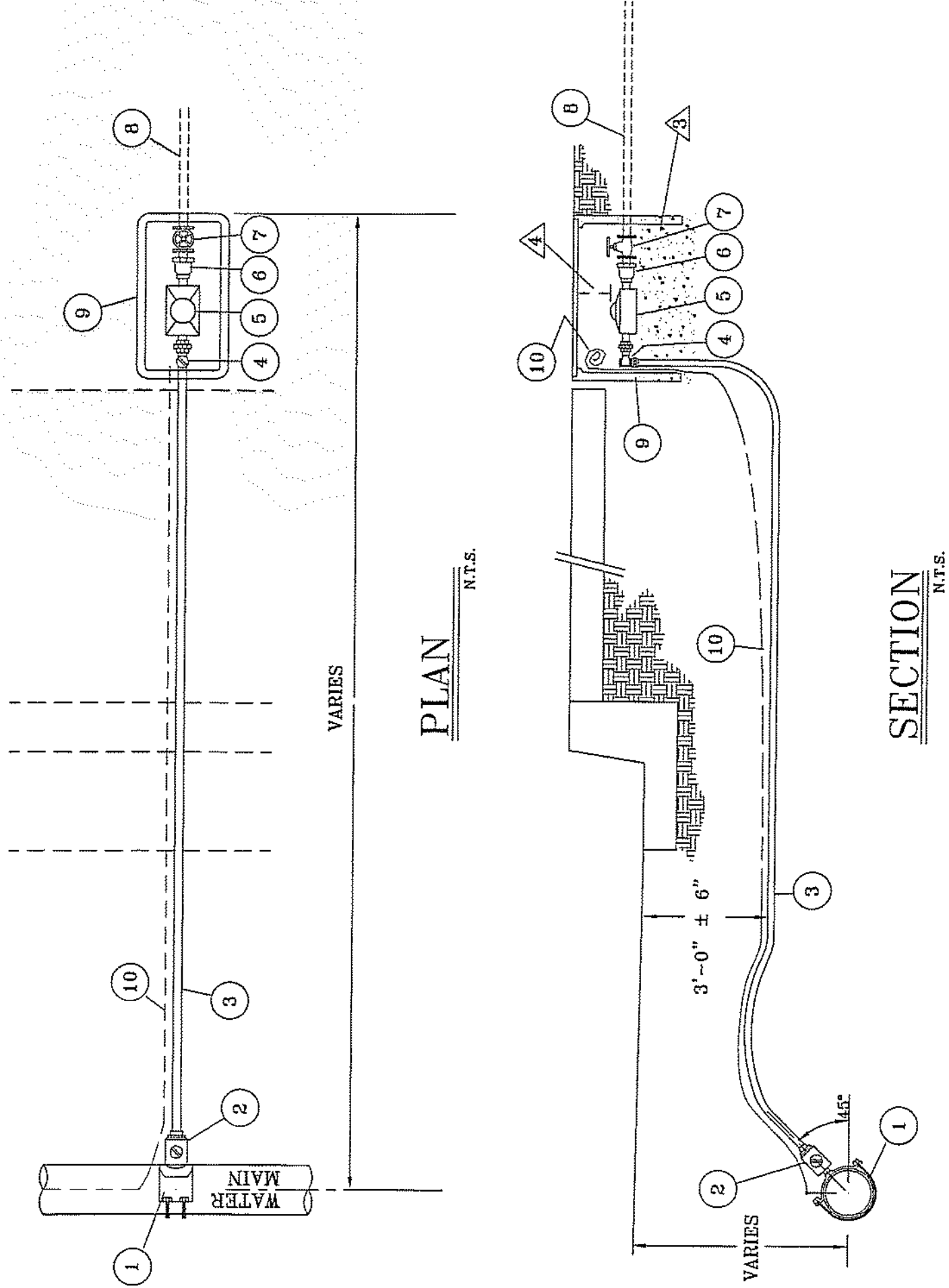
TYPICAL FIRE HYDRANT INSTALLATION
(THRUST BLOCKED)



LEGEND

1. MAIN SIZE X 6" FLG. TEE
2. 6" FLG. X M.J. GATE VALVE
3. 6" VALVE BOX PIPE WITH LID
4. PRE ASSEMBLED FIRE HYDRANT

TYPICAL SINGLE 5/8" x 3/4" METER INSTALLATION ASSEMBLY



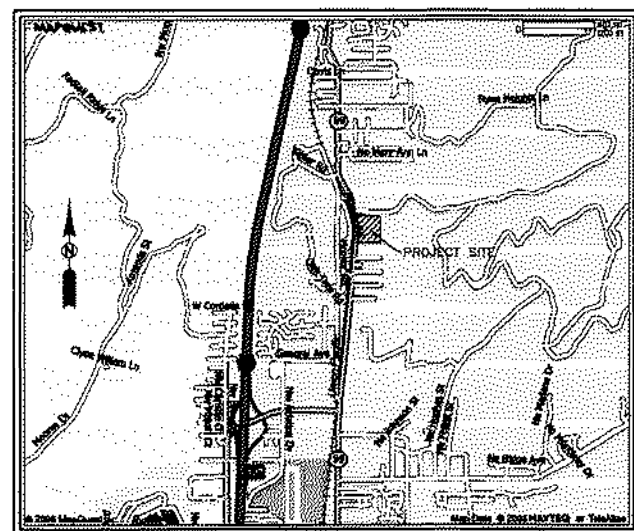
ITEM	SIZE	DESCRIPTION	TYPE	QTY
1	AS REQ'D	SERVICE SADDLE	FORD, CC THD.	1
2	1"	CORP STOP	FORD, F1001 (CC x PACK JOINT)	1
3	1"	SERVICE PIPE	200 p.s.i. POLYETHYLENE SDR7 (PE 3408)	AS REQ'D
4	1" x 3/4"	ANGLE STOP	FORD, KV63-342W (PACK JOINT)	1
5	5/8"x3/4"	METER	CU. FT. READ - PER WATER DEPT. REQUIREMENTS	1
6	3/4"	STRAIGHT CHECK VALVE	FORD, H38-323 (METER NUT x MIPT)	1
7	3/4"	VALVE	BRONZE, HAND WHEEL, FIPT	1
8	—	CUSTOMER SERVICE	PER STATE PLUMBING CODE	—
9	—	METER BOX	BROOKS, NO. 37 W/TYPE S COVER & C.I. LID	1
10	NO. 12	TONE WIRE	ELECTRICAL THHN STRANDED COPPER WIRE, COIL 12" IN METER BOX.	AS REQ'D

NOTES:

- 1 OR APPROVED EQUAL. SEE GENERAL SPECIFICATIONS.
- 2 TYPE AS APPROVED BY MANUFACTURER FOR WATER MAIN TYPE & SIZE.
- 3 PLACE 12" OF 3/4" -0" CRUSHED ROCK IN THE BOTTOM OF THE METER BOX HOLE.
- 4 TOP OF METER SHALL BE 4" TO 6" BELOW BOTTOM OF LID.

COSTCO WHOLESALE WAREHOUSE

CIVIL CONSTRUCTION PLANS



VICINITY MAP
N.T.S.

DEVELOPER:
POWELL DEVELOPMENT
2625 NORTHUP WAY
BELLEVUE, WA 98004

PROJECT ADDRESS:
4119 NE STEPHENS ST
ROSEBURG, OR 97470

PARCELS / TAX LOTS

TAX ACCT. NOS: R121015, R72564, R72364
R72578, R72585, R72571
TAX IDS: 2606360000102, 2606360000600,
2606360000700, 2606360000501,
2606360000500

ZONING AUTHORITY

ZONE: MU
COMP. PLAN: IND
WATER: C.O.R. WATER
SEWER: R.U.S.A.

SHEET INDEX:

- 1) COVER
- 2) PLAN
- 3) PLAN
- 4) DETAILS

GENERAL WATER NOTES:

1. ALL WATER SYSTEM WORK SHALL BE IN CONFORMANCE WITH SECTIONS 2, 3 & 4 OF THE CITY OF ROSEBURG "GENERAL SPECIFICATIONS... MATERIALS AND INSTALLATION OF WATER MAINS" DATED JAN. 2006, AVAILABLE FROM THE CITY OF ROSEBURG WATER DEPARTMENT. IN CASES OF CONFLICT THE CITY OF ROSEBURG SPECIFICATIONS SHALL TAKE PRECEDENCE OVER THE STANDARD SPECIFICATIONS.
2. ALL PIPE FOR WATER MAINLINES SHALL BE CLASS 50 DUCTILE IRON (DI) PIPE, EXCEPT 4" WHICH SHALL BE CLASS 52 AND 6" WHICH SHALL BE CLASS 51. PLEASE SEE PROJECT SPECIFICATIONS FOR DETAILS. ALL FLANGED PIPE SHALL CONFORM TO AWWA C115.
3. THE CONTRACTOR SHALL FLUSH, HYDROSTATICALLY TEST, AND CHLORINATE ALL NEW WATER MAINLINES INSTALLED. THE ENGINEER AND CITY OF ROSEBURG SHALL WITNESS ALL TESTS MADE BY THE CONTRACTOR TO INSURE THEY ARE PERFORMED PROPERLY. TEST PRESSURES SHALL BE DETERMINED BY THE ENGINEER PRIOR TO TESTING.
4. ALL CONSTRUCTION & TESTING IS SUBJECT TO INSPECTION BY THE CITY OF ROSEBURG WATER DEPARTMENT AND THE ENGINEER. THE CONTRACTOR SHALL GIVE THE CITY AND THE ENGINEER 48 HOURS NOTICE PRIOR TO BEGINNING CONSTRUCTION AND 24 HOURS NOTICE PRIOR TO TESTING.
5. NO OTHER MAJOR UTILITIES SHALL RUN PARALLEL WITHIN THREE (3) FEET OF THE NEW WATERMAIN.
6. THRUST BLOCKS SHALL BE INSTALLED AT ALL BENDS AND FITTINGS AS PER CITY OF ROSEBURG STANDARD DRAWING NO. 102. MEGA-LUG RESTRAINTS (OR APPROVED EQUAL) ARE REQUIRED ON ALL FITTINGS IN ADDITION TO STANDARD THRUST BLOCKS.
7. SERVICE WORK SHALL BE PROVIDED BY THE CONTRACTOR. CITY CREWS WILL SET METER AND APPURTENANCES. FOR STANDARD SERVICE CONNECTION SEE CITY STANDARD DRAWING 108A.
8. ALL CITY WATER FACILITIES OUTSIDE RIGHT-OF-WAYS SHALL BE WITHIN EASEMENTS, INCLUDING ALL WATER MAINS, FIRE HYDRANTS, AIR RELEASE VALVES, BLOWOFFS, WATER SERVICE LINES, WATER METERS, ETC. ALL WATERMAIN CENTERLINES SHALL BE LOCATED A MINIMUM OF 7.5 FEET FROM SIDE OF EASEMENT. MINIMUM EASEMENT WIDTH SHALL BE 15 FEET.
9. THE CITY OF ROSEBURG SHALL BE THE SOLE OPERATOR OF ALL WATERLINE VALVES ON THE EXISTING WATER SYSTEM. AT NO TIME SHALL THE CONTRACTOR OPERATE EXISTING VALVES TO SHUT OFF OR PRESSURIZE THE PIPELINE.
10. TONING WIRE FOR WATER LINES SHALL BE 12-GAGE STRANDED COPPER WIRE WITH BLUE THIN INSULATION. ALL TONE WIRE SHALL BE TESTED PRIOR TO ACCEPTANCE. TONE WIRE SHALL BE PLACED 6 INCHES ABOVE PIPE IN ROCK BEDDING. TONE WIRE SHALL NOT BE PLACED IN BOTTOM OF TRENCH OR DIRECTLY ON TOP OF PIPE.
11. PRIOR TO THE SUBSTITUTION OF ANY FITTINGS SPECIFIED BY ENGINEER, REVISED PLANS SHALL BE SUBMITTED AND APPROVED PRIOR TO CONSTRUCTION BY BOTH THE CITY AND ENGINEER.
12. ALL WATER / STORM SEWER CROSSINGS SHALL COMPLY WITH OAR 333.
13. CONTRACTOR SHALL USE WATEROUS HYDRANTS AND AMERICAN FLOW CONTROL VALVES.
14. ALL BACKFLOW AND CHECK VALVE ASSEMBLIES ON DOMESTIC AND FIRE LINES WILL BE INSTALLED ON THE INTERIOR OF THE COSTCO WAREHOUSE BUILDING. PLEASE SEE BUILDING PLUMBING PLANS FOR DETAILS. THE DOUBLE CHECK BACKFLOW PREVENTION ASSEMBLY FOR THE IRRIGATION SYSTEM SHALL BE LOCATED OUTSIDE THE BUILDING BEHIND THE IRRIGATION WATER METER. PLANS AND DETAILS FOR THIS DEVICE ARE SHOWN ON THE LANDSCAPE AND IRRIGATIONS PLANS.
15. PIPING BETWEEN THE EXTERIOR FDC AND THE CHECK VALVE IN THE FIRE DEPARTMENT INLET PIPE SHALL BE HYDROSTATICALLY TESTED IN THE SAME MANNER (200 LBS FOR 2 HOURS) AS THE BALANCE OF THE SYSTEM (NFPA 13-24.2.1.10).
16. EACH FDC TO SPRINKLER SYSTEMS SHALL BE DESIGNATED BY A SIGN HAVING RAISED OR ENGRAVED LETTERS AT LEAST 1 INCH IN HEIGHT ON PLATE OR OR FITTING READING; SERVICE DESIGN - FOR EXAMPLE; AUTOSPUR., OPEN SPUR., AND STANDPIPE. (NFPA 13-8.17.2.4.7.1)
17. A LISTED CHECK VALVE SHALL BE INSTALLED IN EACH FDC. (NFPA 13-8.17.25.1). SEE BUILDING PLUMBING PLANS PER DETAILS.

SPECIAL NOTES:

1. ALL WATERLINE CONSTRUCTION AND RELATED WORK AS SHOWN ON THESE PLANS, AND NOT CALLED OUT AS BEING DONE BY CITY CREWS, SHALL BE DONE BY THE DEVELOPER'S GENERAL CONTRACTOR EXCEPT THE FOLLOWING:
 - A. COSTCO'S GENERAL CONTRACTOR SHALL ADJUST ALL VALVES AND VALVE BOX ASSEMBLY'S TO FINISHED GRADE.
 - B. COSTCO'S GENERAL CONTRACTOR SHALL INSTALL ALL WATERLINE PIPE AND FITTINGS PAST THE WATER METERS, AS SHOWN ON THE WATER METER DETAIL.
2. DEVELOPER'S GENERAL CONTRACTOR SHALL BRING ALL WATER LINES UP TO A POINT 10 FEET FROM THE EXTERIOR OF THE BUILDING. ALL LINES SHOULD BE CAPPED AND MARKED WITH A 2X4 LISTING THE INVERT ELEVATIONS OF THE LINE AND LINE SIZE. IT SHALL BE THE COSTCO GENERAL CONTRACTOR'S RESPONSIBILITY TO REMOVE THE CAP OR PLUG, PROVIDE AND INSTALL ANY FITTINGS AS NEEDED TO CONTINUE/CONNECT THE PIPE INTO THE BUILDING AT NO ADDITIONAL COST TO THE DEVELOPER OR OWNER.
3. TESTING AND DISINFECTION AS REQUIRED BY THE CITY SHALL BE PERFORMED BY THE DEVELOPER'S GENERAL CONTRACTOR.

CALL BEFORE YOU DIG 1
ONE CALL: (800) 332-2344
OAR 952-001-0010 THROUGH
OAR 952-001-0090

* ALL QUANTITIES GIVEN ARE ESTIMATED AND
FOR INFORMATION ONLY. CONTRACTOR
SHALL VERIFY ALL QUANTITIES.

0' 50' 100' 200'
SCALE: 1"=100'



Rev.	Date	Dwg	Description
1	10/22/09	ANY	CITY REVIEW
2	1/15/10	ANY	CONSTRUCTION SET
3	7/12/10	JD	AS-BUILT

i.e. 1809 SE Pine Street
Roseburg, Oregon 97470
PHONE (541) 673-0166
FAX (541) 440-9392
EMAIL: iemail@ieengineering.com

Project Name:
COSTCO WHOLESALE WAREHOUSE
CIVIL CONSTRUCTION PLANS

Title:
WATER PLANS
COVER SHEET
DES DMA PROJECT NO. 2329-01
DWG BWC DATE: OCTOBER 28, 2009
CHK AMP SCALE: AS SHOWN
APP AMP SHEET: 1 OF 4

DO NOT DUPLICATE

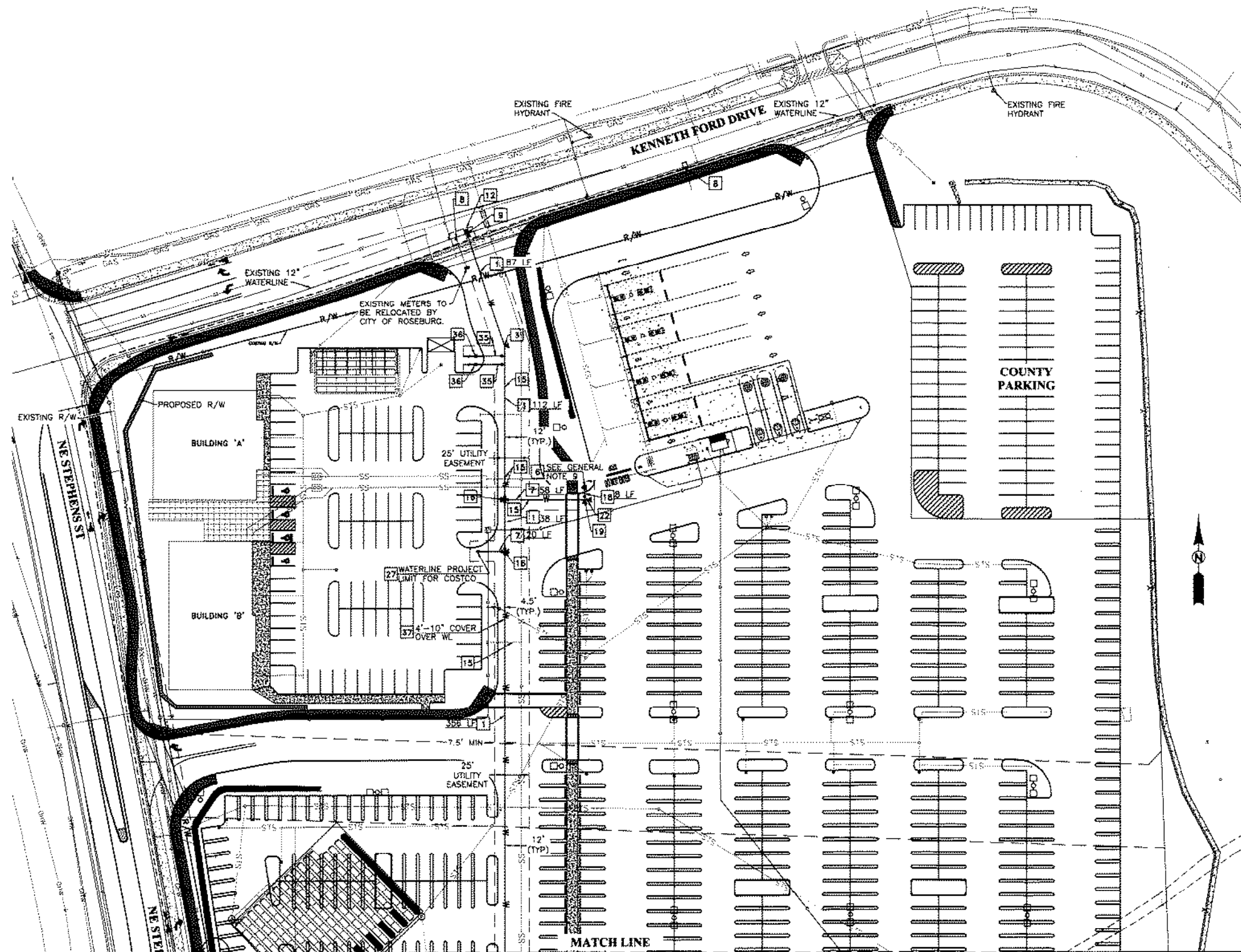
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KEYED WATER NOTES:

1. INSTALL 12" DUCTILE IRON WATERMAIN LINE IN STANDARD TRENCH PER STANDARD DRAWING No.101. MINIMUM COVER TO TOP OF INSTALLED PIPE SHALL BE 36". LENGTH PER PLAN.
2. INSTALL 12" 1 1/2" DUCTILE IRON BEND (MxMJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102.
3. INSTALL 12" 22 1/2" DUCTILE IRON BEND (MxMJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102.
4. INSTALL 12" 45" DUCTILE IRON BEND (MxMJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102.
5. INSTALL: (1) 12" TEE (FLGxFLG), (2) 12" GATE VALVE (FLGxMJ), (1) 12"x8" REDUCER (FLG), (1) 8" GATE VALVE (FLGxMJ), (1) 8" FOSTER ADAPTER, (1) 8" 1 1/4" BEND (MxMJ), AND THRUST BLOCKS.
6. INSTALL FIRE HYDRANT ASSEMBLY PER STANDARD DRAWING No.105, INCLUDING MxFLG TEE WITH A 6" MxFLG GATE VALVE.
7. INSTALL 8" DUCTILE IRON WATER MAINLINE IN STANDARD TRENCH PER STANDARD DRAWING No.101. MINIMUM COVER TO TOP OF INSTALLED PIPE SHALL BE 36". LENGTH PER PLAN.
8. REMOVE EXISTING 2" GATE VALVE AND INSTALL BRASS PLUG ON SERVICE SADDLE, ABANDON PER C.O.R. STANDARDS. ALL WORK ASSOCIATED WITH THE WATER LINE SHALL BE DONE BY ROSEBURG WATER DEPARTMENT. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION WITH CITY WATER DEPT. ALL WORK ASSOCIATED WITH PAVEMENT REMOVAL AND REPLACEMENT, BACKFILL, SAWCUTTING, ETC., SHALL BE DONE BY CONTRACTOR.
9. TIE INTO EXISTING 12" DUCTILE IRON PIPE WITH NEW 12" DUCTILE IRON PIPE PER "TIE-IN DETAIL B" ON SHEET 4. SEE GENERAL NOTES 1 & 7.
10. TIE INTO EXISTING 20" O.D. STEEL PIPE WITH NEW 12" DUCTILE IRON PIPE PER "TIE-IN DETAIL A" ON SHEET 4. SEE GENERAL NOTE 7. POT HOLE PRIOR TO CONSTRUCTION TO VERIFY MATERIAL, LOCATION, AND DEPTH OF EXISTING 20" WATERLINE.
11. 2-INCH THICK GRIND OUT/PAVEMENT OVERLAY. 20' WIDE, CENTERED 10' EITHER SIDE OF WATERLINE TRENCH. CLASS 'B' TRENCH BACKFILL PER ODOT DETAIL RD 300 & RD 302.
12. SAWCUT LOCATION-- SEE GENERAL WATER NOTE #8, THIS SHEET.
13. INSTALL FIRE HYDRANT TYPICAL EXTRUDED BOLLARD. MINIMUM 3' CLEARANCE BETWEEN HYDRANT AND BOLLARD.
14. INSTALL 8" 90" DUCTILE IRON BEND (MxMJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102.
15. CONTRACTOR SHALL ENSURE THAT ALL SANITARY SEWER AND WATER LINE CROSSINGS MEET THE REQUIREMENTS AS SET FORTH BY DEPARTMENT OF HEALTH AND HUMAN SERVICES OAR 333-061-0050 (9).
16. INSTALL 12"x8" TEE (FLGxFLG) WITH 1 - 8" GATE VALVE (FLGxMJ), 2 - 12" GATE VALVES (FLGxMJ), AND THRUST BLOCK.
17. INSTALL 12"x8" TEE (FLGxMJ) WITH 2 - 12" GATE VALVES (FLGxMJ), AND THRUST BLOCK.
18. INSTALL 6" DUCTILE IRON PIPE IN STANDARD TRENCH PER STANDARD DRAWINGS No.101 & 105. MINIMUM COVER TO TOP OF INSTALLED PIPE SHALL BE 36". LENGTH PER PLAN.
19. INSTALL (1) 8"x8" TEE (MxFLG) WITH (1) 6" GATE VALVE (FLGxMJ), AND THRUST BLOCK PER STANDARD DRAWING No.102.
20. INSTALL FIRE DEPARTMENT CONNECTION.
21. INSTALL 6" DUCTILE IRON MAINLINE FROM FDC TO FIRE RISER ROOM IN COMMON TRENCH WITH 12" WATERLINE, PER STANDARD DRAWING No.101. COVER SHALL BE 30". MINIMUM 5 FEET SEPARATION. LENGTH PER PLAN. (SEE PLUMBING/FIRE PROTECTION PLAN FOR CONTINUATION INTO THE BUILDING)
22. INSTALL 8" MJ CAP OR PLUG, AND THRUST BLOCK PER STANDARD DRAWING No.102.
23. INSTALL 12"x4" TEE (MxFLG) WITH 1-4" GATEVALVE (FLGxMJ), AND THRUST BLOCK PER STANDARD DRAWING No.102.
24. INSTALL 4" DUCTILE IRON WATER MAINLINE IN STANDARD TRENCH PER STANDARD DRAWING No.101. MINIMUM COVER TO TOP OF INSTALLED PIPE SHALL BE 36". LENGTH PER PLAN.
25. INSTALL 8" 1 1/4" DUCTILE IRON BEND WITH THRUST BLOCK PER STANDARD DRAWING No.102.
26. INSTALL AIR RELEASE VALVE AT HIGH POINT, PER STANDARD DRAWING No.107A.
27. INSTALL 2" STANDARD BLOW OFF ASSEMBLY PER STANDARD DRAWING No.104.
28. EXISTING 2" DOMESTIC METER ASSEMBLY, TO BE RELOCATED TO THIS LOCATION BY CITY OF ROSEBURG. SEE DETAIL SHEET 4. SEE PLUMBING PLANS FOR CONTINUATION OF 2" DOMESTIC SERVICE LINE INTO BUILDING.
29. EXISTING 1 1/2" IRRIGATION METER ASSEMBLY, TO BE RELOCATED TO THIS LOCATION BY CITY OF ROSEBURG. SEE DETAIL SHEET 4. SEE LANDSCAPE AND IRRIGATION PLANS FOR CONTINUATION OF 2" IRRIGATION SERVICE LINE. SEE GENERAL WATER NOTE #3 ON THIS SHEET.
30. INSTALL 12" 90" DUCTILE IRON BEND (FLGxMJ) WITH 12" GATE VALVE (MxFLG) AND THRUST BLOCK.
31. CONTRACTOR SHALL POT HOLE EXISTING 30" WL TO VERIFY CLEARANCE AND SHALL CONSULT ENGINEER IF ADJUSTMENTS TO NEW 12" LINE ARE REQUIRED.
32. INSTALL 8" GATEVALVE (MJ)
33. INSTALL FLANGE BASED POST INDICATOR PER DETAIL.
34. INSTALL 6" 90" DUCTILE IRON BEND (MxMJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102.
35. INSTALL 2" METER ASSEMBLY PER STANDARD DETAIL No.111.
36. EXISTING 1 1/2" METER ASSEMBLY TO BE RELOCATED TO THIS LOCATION BY CITY OF ROSEBURG.
37. WATERMAIN TO CROSS UNDER STORM SEWER WITH MINIMUM 1 FOOT VERTICAL SEPARATION, AS SHOWN ON PLANS. CONTRACTOR TO DEFLECT PIPE AT EITHER SIDE OF CROSSING PER ALLOWABLE MANUFACTURER'S RECOMMENDATIONS.
38. INSTALL 6" 1 1/4" DUCTILE IRON BEND (MxMJ) w/THRUST BLOCK PER STANDARD DRAWING No.102.
39. INSTALL 8" 90" DUCTILE IRON VERTICAL BEND (MJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102. INSTALL DUCTILE IRON SPOOL (FLGxPE), LENGTH AS REQUIRED. TOP OF FLANGE TO BE 1' ABOVE PUMP ROOM FINISHED FLOOR ELEVATION.
40. INSTALL 6" 90" DUCTILE IRON VERTICAL BEND (MJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102. INSTALL DUCTILE IRON SPOOL (FLGxPE), LENGTH AS REQUIRED. TOP OF FLANGE TO BE 1' ABOVE PUMP ROOM FINISHED FLOOR ELEVATION.

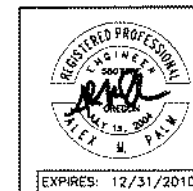
GENERAL WATER NOTES:

1. CONTRACTOR SHALL PROVIDE AND INSTALL ALL APPURTENANCES AS NEEDED FOR, AND SHALL COORDINATE DIRECTLY WITH CITY OF ROSEBURG WATER DEPARTMENT FOR ALL CONNECTIONS TO EXISTING WATERLINES (OR INSTALLATIONS OF SAID APPURTENANCES). CONTRACTOR SHALL NOT PERFORM ANY WORK ON CITY OWNED PORTION OF ANY WATERLINE EXCEPT WITH AUTHORIZATION FROM AND IN THE PRESENCE OF AN AUTHORIZED REPRESENTATIVE FROM THE CITY OF ROSEBURG PUBLIC WORKS DEPARTMENT.
2. CONTRACTOR SHALL PROTECT ALL LINES AT ALL SANITARY SEWER CROSSINGS PER OAR 333-061-0050 (9).
3. REFERENCE LANDSCAPE AND IRRIGATION PLANS FOR DOUBLE-CHECK BACKFLOW ASSEMBLY FOR IRRIGATION SERVICE.
4. (NOT USED)
5. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS AS NEEDED TO CONSTRUCT THE PROPOSED IMPROVEMENTS WITHIN THE RIGHT-OF-WAY OF HWY. 99 AT NO ADDITIONAL COST TO THE DEVELOPER.



6. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL TRAFFIC CONTROL AS NEEDED DURING CONSTRUCTION OF NEW WATERLINE UNDER AND ALONG HWY. 99. CONTRACTOR SHALL ALSO PREPARE AND SUBMIT A TRAFFIC CONTROL PLAN (IF REQUIRED) AT NO ADDITIONAL COST TO THE DEVELOPER.
7. CONTRACTOR SHALL TEST AND DISINFECT NEW LINE PRIOR TO CONNECTION TO ANY EXISTING LINE.
8. REFERENCE OFFSITE AND DEMO PLANS FOR PAVEMENT SAWCUT, REMOVAL AND REPLACEMENT NOTES.
9. HYDRANT WILL BENEFIT FUEL FACILITY.
10. MEGA-LUG RESTRAINTS (OR APPROVED EQUAL) ARE REQUIRED ON ALL FITTINGS IN ADDITION TO STANDARD THRUST BLOCKS.
11. ALL BUILDING UTILITY CONNECTIONS AND STUB-OUTS SHALL BE CONSTRUCTED AT AN ELEVATION AND GRADE SO THAT THE ENTIRE UTILITY LINE IS LOCATED UNDERNEATH THE FOOTING ALONG THE OUTSIDE PERIMETER OF THE BUILDING. UTILITY LINES SHALL NOT BE CONSTRUCTED ABOVE OR THROUGH THE BUILDING FOOTINGS. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL VERIFY THAT ALL GRADES AS SHOWN ON THE PLANS WILL ALLOW ADEQUATE CLEARANCE UNDER THE BUILDING FOOTINGS. CONTRACTOR SHALL ALERT ENGINEER IF ANY CONFLICTS EXIST PRIOR TO CONSTRUCTION.

*ALL QUANTITIES GIVEN ARE ESTIMATED AND FOR INFORMATION ONLY. CONTRACTOR SHALL VERIFY ALL QUANTITIES.



Rev.	Date	Dwg	Description
1	10/22/09	ANY	CITY REVIEW
2	11/11/09	ANY	APPENDUM #2
3	1/15/10	ANY	CONSTRUCTION SET
4	2/17/10	ANY	PR-D1
5	7/12/10	JPL	AS-BUILT

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ONE CALL: (800) 332-2344
OR 952-001-0010 THROUGH
OR 952-001-0090

SCALE: 1"=20'

i.e. ENGINEERING 809 SE Pine Street Roseburg, Oregon 97470 PHONE (541) 673-0166 FAX (541) 440-9392 jamall@ieengineering.com	Project Name: COSTCO WHOLESALE WAREHOUSE CIVIL CONSTRUCTION PLANS	
	Title: WATERLINE PLAN	
	DES. DWA	PROJECT NO. 2329-01
	DWG. BWC	DATE: OCTOBER 26, 2009
CHK. AMP	SCALE: AS SHOWN	
APP. AMP	SHEET: 2 OF 4	

DO NOT DUPLICATE

IOWA07

KEYED WATER NOTES:

1. INSTALL 12" DUCTILE IRON WATERMAIN LINE IN STANDARD TRENCH PER STANDARD DRAWING No.101. MINIMUM COVER TO TOP OF INSTALLED PIPE SHALL BE 36". LENGTH PER PLAN.
2. INSTALL 12" 11/2" DUCTILE IRON BEND (MJKMJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102.
3. INSTALL 12" 22 1/2" DUCTILE IRON BEND (MJKMJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102.
4. INSTALL 12" 45" DUCTILE IRON BEND (MJKMJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102.
5. INSTALL: (1) 12" TEE (FLGXFLG), (2) 12" GATE VALVE (FLGXMJ), (1) 12"x8" REDUCER (FLG), (1) 8" GATE VALVE (FLGXMJ), (1) 8" FOSTER ADAPTER, (1) 8" 11/2" BEND (MJKMJ), AND THRUST BLOCKS.
6. INSTALL FIRE HYDRANT ASSEMBLY PER STANDARD DRAWING No.105, INCLUDING MJKFLG TEE WITH A 6" MJKFLG GATE VALVE.
7. INSTALL 8" DUCTILE IRON WATER MAINLINE IN STANDARD TRENCH PER STANDARD DRAWING No.101. MINIMUM COVER TO TOP OF INSTALLED PIPE SHALL BE 36". LENGTH PER PLAN.
8. REMOVE EXISTING 2" GATE VALVE AND INSTALL BRASS PLUG ON SERVICE SADDLE, ABANDON PER C.O.R. STANDARDS. ALL WORK ASSOCIATED WITH THE WATER LINE SHALL BE DONE BY ROSEBURG WATER DEPARTMENT. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION WITH CITY WATER DEPT. ALL WORK ASSOCIATED WITH PAVEMENT REMOVAL AND REPLACEMENT, BACKFILL, SAWCUTTING, ETC., SHALL BE DONE BY CONTRACTOR.
9. TIE INTO EXISTING 12" DUCTILE IRON PIPE WITH NEW 12" DUCTILE IRON PIPE PER "TIE-IN DETAIL B" ON SHEET 4. SEE GENERAL NOTES 1 & 7.
10. TIE INTO EXISTING 20" O.D. STEEL PIPE WITH NEW 12" DUCTILE IRON PIPE PER "TIE-IN DETAIL A" ON SHEET 4. SEE GENERAL NOTE 7. POTHOLE PRIOR TO CONSTRUCTION TO VERIFY MATERIAL, LOCATION, AND DEPTH OF EXISTING 20" WATERLINE.
11. 2-INCH THICK GRIND OUT/PAVEMENT OVERLAY, 20' WIDE, CENTERED 10' EITHER SIDE OF WATERLINE TRENCH. CLASS "B" TRENCH BACKFILL PER ODOT DETAIL RD 300 & RD 302.
12. SAWCUT LOCATION- SEE GENERAL WATER NOTE #8, THIS SHEET.
13. INSTALL FIRE HYDRANT TYPICAL EXTRUDED BOLLARD, MINIMUM 3' CLEARANCE BETWEEN HYDRANT AND BOLLARD.
14. INSTALL 8" 90" DUCTILE IRON BEND (MJKMJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102.
15. CONTRACTOR SHALL ENSURE THAT ALL SANITARY SEWER AND WATER LINE CROSSINGS MEET THE REQUIREMENTS AS SET FORTH BY DEPARTMENT OF HEALTH AND HUMAN SERVICES OAR 333-061-0050 (9).
16. INSTALL 12"x8" TEE (FLGXFLG) WITH 1 - 8" GATE VALVE (FLGXMJ), 2 - 12" GATE VALVES (FLGXMJ), AND THRUST BLOCK.
17. INSTALL 12"x8" TEE (FLGXMJ) WITH 2 - 12" GATE VALVES (FLGXMJ), AND THRUST BLOCK.
18. INSTALL 8" DUCTILE IRON PIPE IN STANDARD TRENCH PER STANDARD DRAWINGS No.101 & 105. MINIMUM COVER TO TOP OF INSTALLED PIPE SHALL BE 36". LENGTH PER PLAN.
19. INSTALL (1) 8"x6" TEE (MJKFLG) WITH (1) 8" GATE VALVE (FLGXMJ), AND THRUST BLOCK PER STANDARD DRAWING No.102.
20. INSTALL FIRE DEPARTMENT CONNECTION.
21. INSTALL 6" DUCTILE IRON MAINLINE FROM FDC TO FIRE RISER ROOM IN COMMON TRENCH WITH 12" WATERLINE, PER STANDARD DRAWING No.101. COVER SHALL BE 30". MINIMUM 3 FEET SEPARATION. LENGTH PER PLAN. (SEE PLUMBING/FIRE PROTECTION PLAN FOR CONTINUATION INTO THE BUILDING)
22. INSTALL 8" MJ CAP OR PLUG, AND THRUST BLOCK PER STANDARD DRAWING No.102.
23. INSTALL 12"x4" TEE (MJKFLG) WITH 1-4" GATEVALVE (FLGXMJ), AND THRUST BLOCK PER STANDARD DRAWING No.102.
24. INSTALL 4" DUCTILE IRON WATER MAINLINE IN STANDARD TRENCH PER STANDARD DRAWING No.101. MINIMUM COVER TO TOP OF INSTALLED PIPE SHALL BE 36". LENGTH PER PLAN.
25. INSTALL 8" 11/2" DUCTILE IRON BEND WITH THRUST BLOCK PER STANDARD DRAWING No.102.
26. INSTALL AIR RELEASE VALVE AT HIGH POINT, PER STANDARD DRAWING No.107A.
27. INSTALL 2" STANDARD BLOW OFF ASSEMBLY PER STANDARD DRAWING No.104.
28. EXISTING 2" DOMESTIC METER ASSEMBLY, TO BE RELOCATED TO THIS LOCATION BY CITY OF ROSEBURG. SEE DETAIL SHEET 4. SEE PLUMBING PLANS FOR CONTINUATION OF 2" DOMESTIC SERVICE LINE INTO BUILDING.
29. EXISTING 1/2" IRRIGATION METER ASSEMBLY, TO BE RELOCATED TO THIS LOCATION BY CITY OF ROSEBURG. SEE DETAIL SHEET 4. SEE LANDSCAPE AND IRRIGATION PLANS FOR CONTINUATION OF 2" IRRIGATION SERVICE LINE. SEE GENERAL WATER NOTE #3 ON THIS SHEET.
30. INSTALL 12" 90" DUCTILE IRON BEND (FLGXMJ) WITH 12" GATE VALVE (MJKFLG) AND THRUST BLOCK.
31. CONTRACTOR SHALL POTHOLE EXISTING 30" WL TO VERIFY CLEARANCE AND SHALL CONSULT ENGINEER IF ADJUSTMENTS TO NEW 12" LINE ARE REQUIRED.
32. INSTALL 8" GATEVALVE (MJ)
33. INSTALL FLANGE BASED POST INDICATOR PER DETAIL.
34. INSTALL 8" 90" DUCTILE IRON BEND (MJKMJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102.
35. INSTALL 2" METER ASSEMBLY PER STANDARD DETAIL No.111.
36. EXISTING 1/2" METER ASSEMBLY TO BE RELOCATED TO THIS LOCATION BY CITY OF ROSEBURG.
37. WATERMAIN TO CROSS UNDER STORM SEWER WITH MINIMUM 1 FOOT VERTICAL SEPARATION, AS SHOWN ON PLANS. CONTRACTOR TO DEFLECT PIPE AT EITHER SIDE OF CROSSING PER ALLOWABLE MANUFACTURER'S RECOMMENDATIONS.
38. INSTALL 6" 11/2" DUCTILE IRON BEND (MJKMJ) w/THRUST BLOCK PER STANDARD DRAWING No.102.
39. INSTALL 8" 90" DUCTILE IRON VERTICAL BEND (MJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102. INSTALL DUCTILE IRON SPOOL (FLGXPE), LENGTH AS REQUIRED. TOP OF FLANGE TO BE 1' ABOVE PUMP ROOM FINISHED FLOOR ELEVATION.
40. INSTALL 6" 90" DUCTILE IRON VERTICAL BEND (MJ) WITH THRUST BLOCK PER STANDARD DRAWING No.102. INSTALL DUCTILE IRON SPOOL (FLGXPE), LENGTH AS REQUIRED. TOP OF FLANGE TO BE 1' ABOVE PUMP ROOM FINISHED FLOOR ELEVATION.

GENERAL WATER NOTES:

1. CONTRACTOR SHALL PROVIDE AND INSTALL ALL APPURTENANCES AS NEEDED FOR, AND SHALL COORDINATE DIRECTLY WITH CITY OF ROSEBURG WATER DEPARTMENT FOR ALL CONNECTIONS TO EXISTING WATERLINES (OR INSTALLATIONS OF SAID APPURTENANCES). CONTRACTOR SHALL NOT PERFORM ANY WORK ON CITY OWNED PORTION OF ANY WATERLINE EXCEPT WITH AUTHORIZATION FROM AND IN THE PRESENCE OF AN AUTHORIZED REPRESENTATIVE FROM THE CITY OF ROSEBURG PUBLIC WORKS DEPARTMENT.
2. CONTRACTOR SHALL PROTECT ALL LINES AT ALL SANITARY SEWER CROSSINGS PER OAR 333-061-0050 (9).
3. REFERENCE LANDSCAPE AND IRRIGATION PLANS FOR DOUBLE-CHECK BACKFLOW ASSEMBLY FOR IRRIGATION SERVICE.
4. (NOT USED)
5. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS AS NEEDED TO CONSTRUCT THE PROPOSED IMPROVEMENTS WITHIN THE RIGHT-OF-WAY OF HWY. 99 AT NO ADDITIONAL COST TO THE DEVELOPER.

6. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL TRAFFIC CONTROL AS NEEDED DURING CONSTRUCTION OF NEW WATERLINE UNDER AND ALONG HWY. 99. CONTRACTOR SHALL ALSO PREPARE AND SUBMIT A TRAFFIC CONTROL PLAN (IF REQUIRED) AT NO ADDITIONAL COST TO THE DEVELOPER.
7. CONTRACTOR SHALL TEST AND DISINFECT NEW LINE PRIOR TO CONNECTION TO ANY EXISTING LINE.
8. REFERENCE OFFSITE AND DEMO PLANS FOR PAVEMENT SAWCUT, REMOVAL AND REPLACEMENT NOTES.
9. HYDRANT WILL BENEFIT FUEL FACILITY.
10. MEGA-LUG RESTRAINTS (OR APPROVED EQUAL) ARE REQUIRED ON ALL FITTINGS IN ADDITION TO STANDARD THRUST BLOCKS.
11. ALL BUILDING UTILITY CONNECTIONS AND STUB-OUTS SHALL BE CONSTRUCTED AT AN ELEVATION AND GRADE SO THAT THE ENTIRE UTILITY LINE IS LOCATED UNDERNEATH THE FOOTING ALONG THE OUTSIDE PERIMETER OF THE BUILDING. UTILITY LINES SHALL NOT BE CONSTRUCTED ABOVE OR THROUGH THE BUILDING FOOTINGS. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL VERIFY THAT ALL GRADES AS SHOWN ON THE PLANS WILL ALLOW ADEQUATE CLEARANCE UNDER THE BUILDING FOOTINGS. CONTRACTOR SHALL ALERT ENGINEER IF ANY CONFLICTS EXIST PRIOR TO CONSTRUCTION.

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Rev.	Date	Dwg	Description
1	10/22/09	ANY	CITY REVIEW
2	11/11/09	ANY	ADDENDUM #2
3	1/14/10	ANY	CONSTRUCTION SET
4	2/12/10	ANY	PR-01
5	7/12/10	JDL	AS-BUILT

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OAR 952-001-0090

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FAX (541) 440-9392
Email: iemail@ieengineering.com

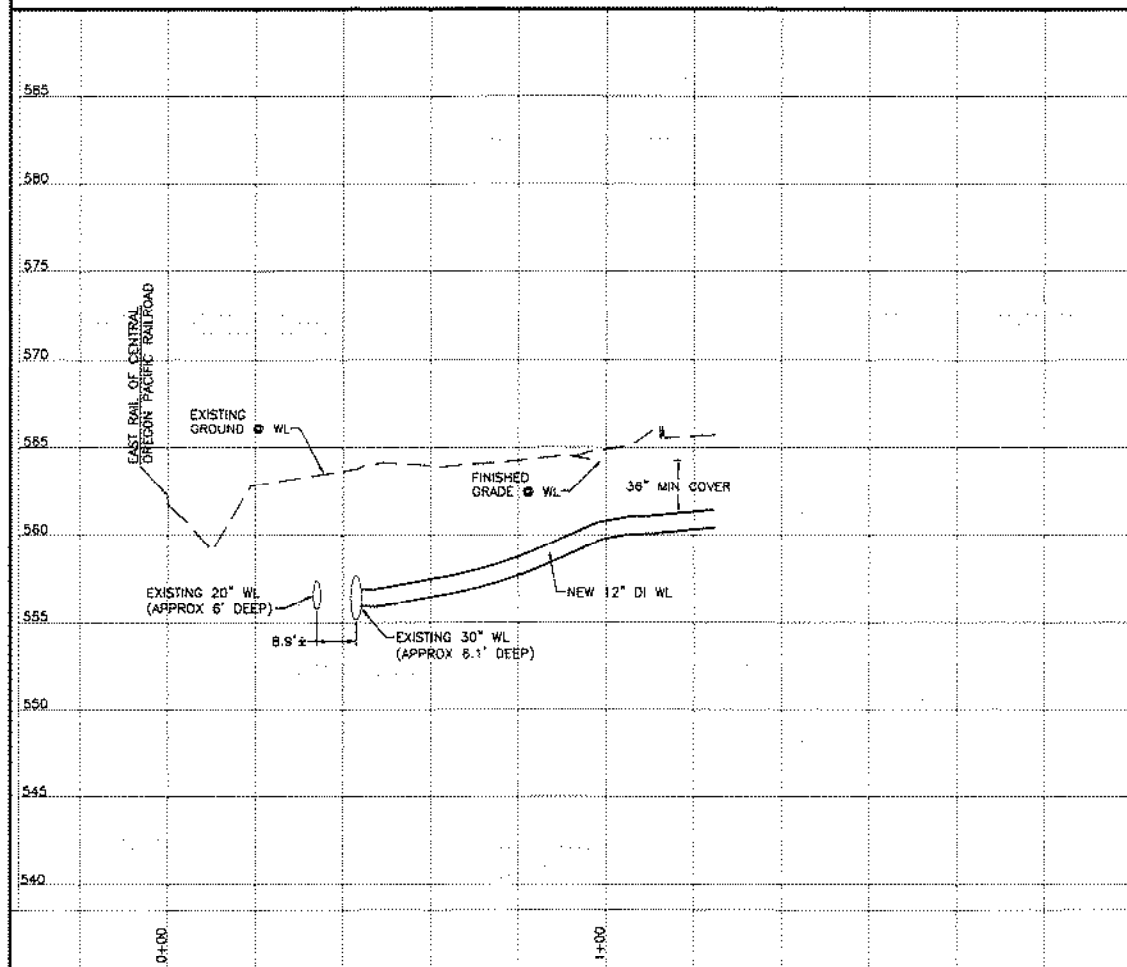
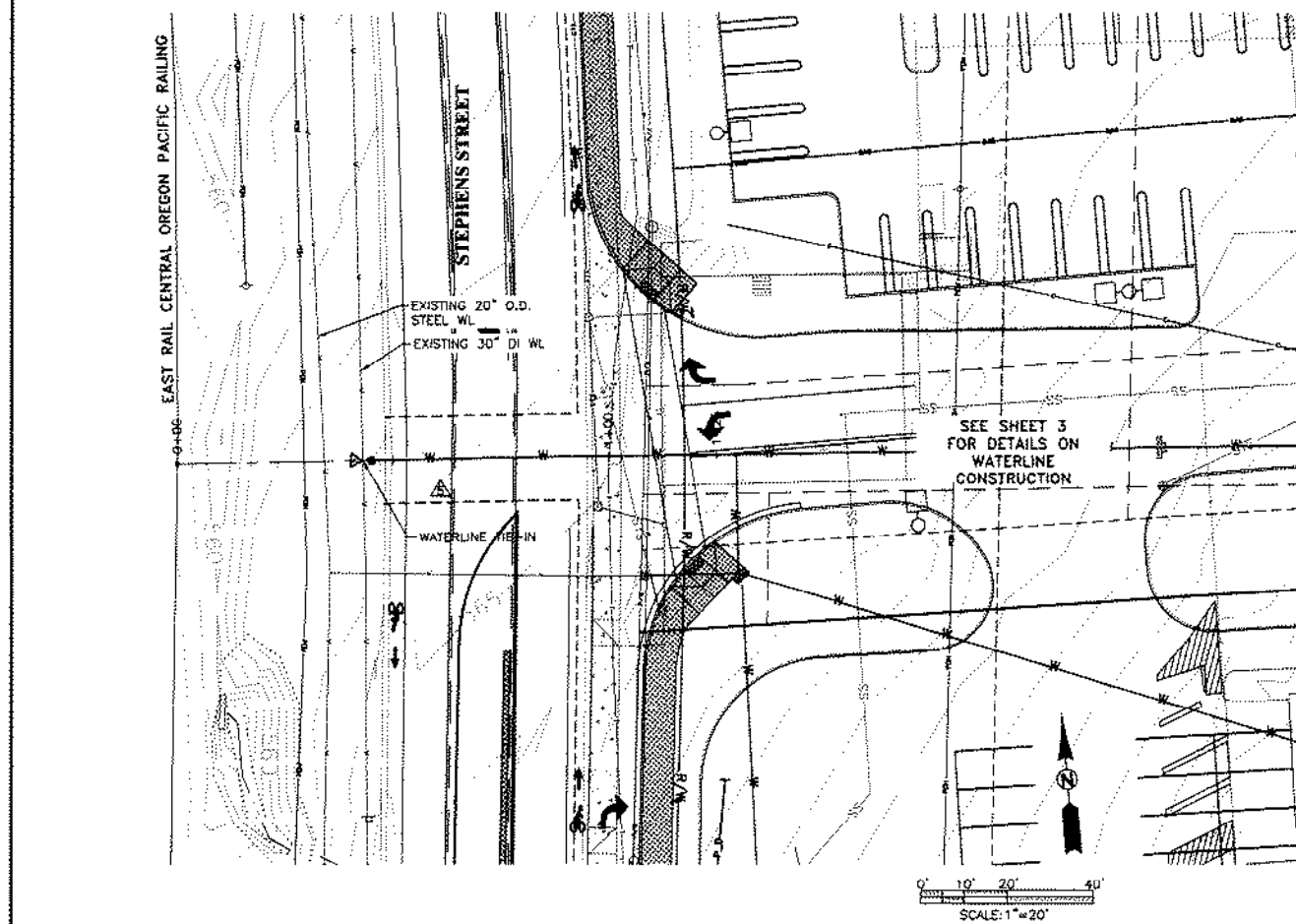
Project Name:
COSTCO WHOLESALE WAREHOUSE CIVIL CONSTRUCTION PLANS

Title:
WATERLINE PLAN

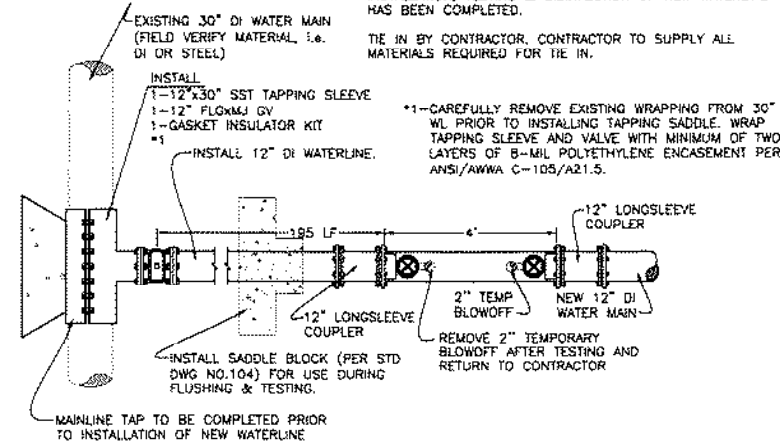
DES. DMA: PROJECT NO. 2329-01
DWG. BWC: DATE: OCTOBER 28, 2009
CHK. AMP: SCALE: AS SHOWN
APP. AMP: SHEET: 3 OF 4

DO NOT DUPLICATE

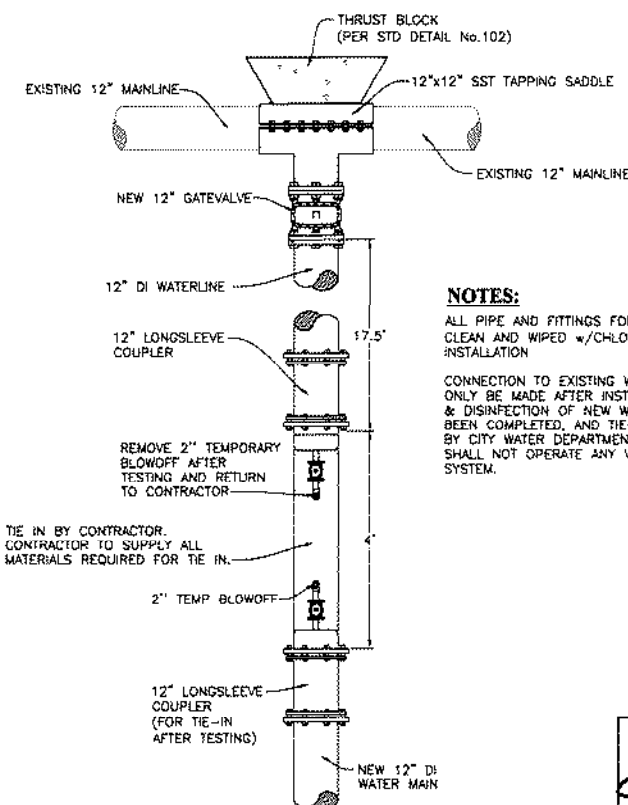
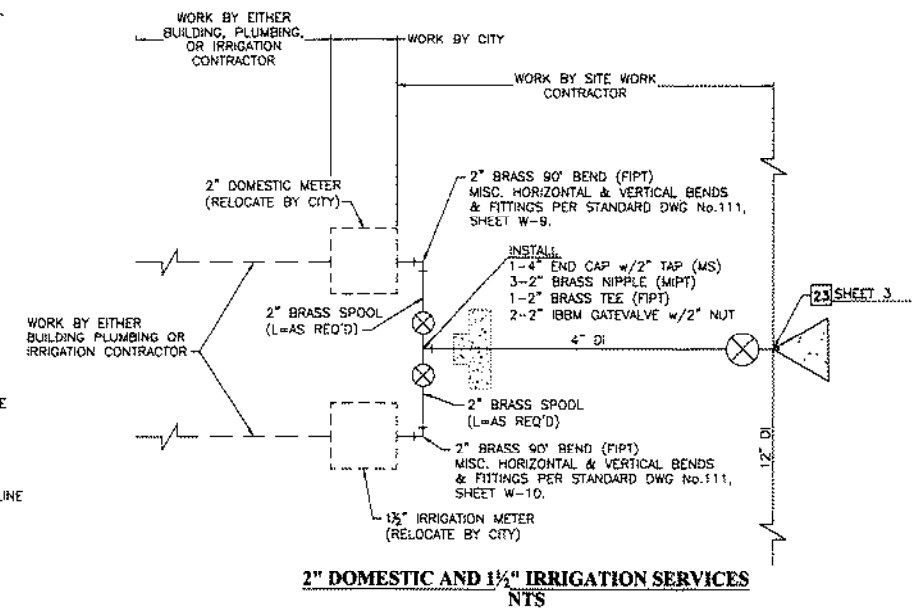
IOWA07



NOTES:
ALL PIPE AND FITTINGS FOR TIE-IN TO BE CLEAN AND WIPED w/CHLORINE PRIOR TO INSTALLATION.
PIPE SIZES ARE SHOWN ON PLANS.
CONTRACTOR TO ALIGN NEW MAINLINE IN BOTH ALIGNMENT AND GRADE w/EXISTING WATERLINE. CONNECTION TO EXISTING WATERLINE CAN ONLY BE MADE AFTER INSTALLATION, TESTING & DISINFECTION OF NEW WATERLINE HAS BEEN COMPLETED.
TIE IN BY CONTRACTOR, CONTRACTOR TO SUPPLY ALL MATERIALS REQUIRED FOR TIE IN.



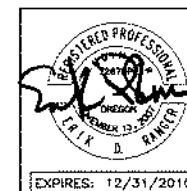
TIE-IN DETAIL 'A'
STEPHENS STREET
N.T.S.



TIE-IN DETAIL 'B'
KENNETH FORD DRIVE
N.T.S.

NOTES:
ALL PIPE AND FITTINGS FOR TIE-IN TO BE CLEAN AND WIPED w/CHLORINE PRIOR TO INSTALLATION.
CONNECTION TO EXISTING WATERLINE CAN ONLY BE MADE AFTER INSTALLATION, TESTING & DISINFECTION OF NEW WATERLINE HAS BEEN COMPLETED, AND TIE-IN IS APPROVED BY CITY WATER DEPARTMENT. CONTRACTOR SHALL NOT OPERATE ANY VALVES ON CITY SYSTEM.

*ALL QUANTITIES GIVEN ARE ESTIMATED AND FOR INFORMATION ONLY. CONTRACTOR SHALL VERIFY ALL QUANTITIES.



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3	2/17/10	ANY	PR-01
6	7/12/10	JDL	AS-BUILT

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Roseburg, Oregon 97470
PHONE (541) 673-0166
FAX (541) 440-9392
email@ieengineering.com

Project Name:
COSTCO WHOLESALE WAREHOUSE
CIVIL CONSTRUCTION PLANS

Title:
STEPHENS ST WATER CROSSING
w/WATER DETAILS

DES DMA PROJECT NO. 2329-01

DWG BWC DATE: OCTOBER 28, 2009

CHK AMP SCALE: VERT. 1"= 5'

APP AMP SHEET: 4 OF 4

DO NOT DUPLICATE

IOWA07



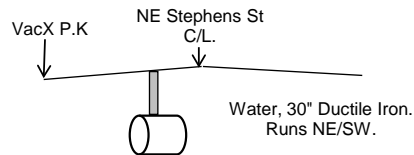
TEST HOLE REPORT SHEET

TH # P-2Utility Coordination Service
(888) 429-VacXVacX # V21-10604Customer: MurraySmithDate: 3/2/2021Utility Owner/operator: City of RoseburgUtility type: Water, 30" Ductile Iron.Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

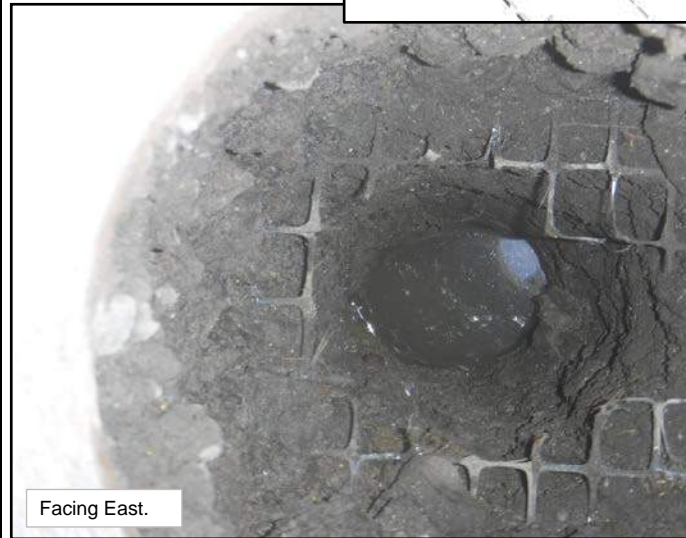
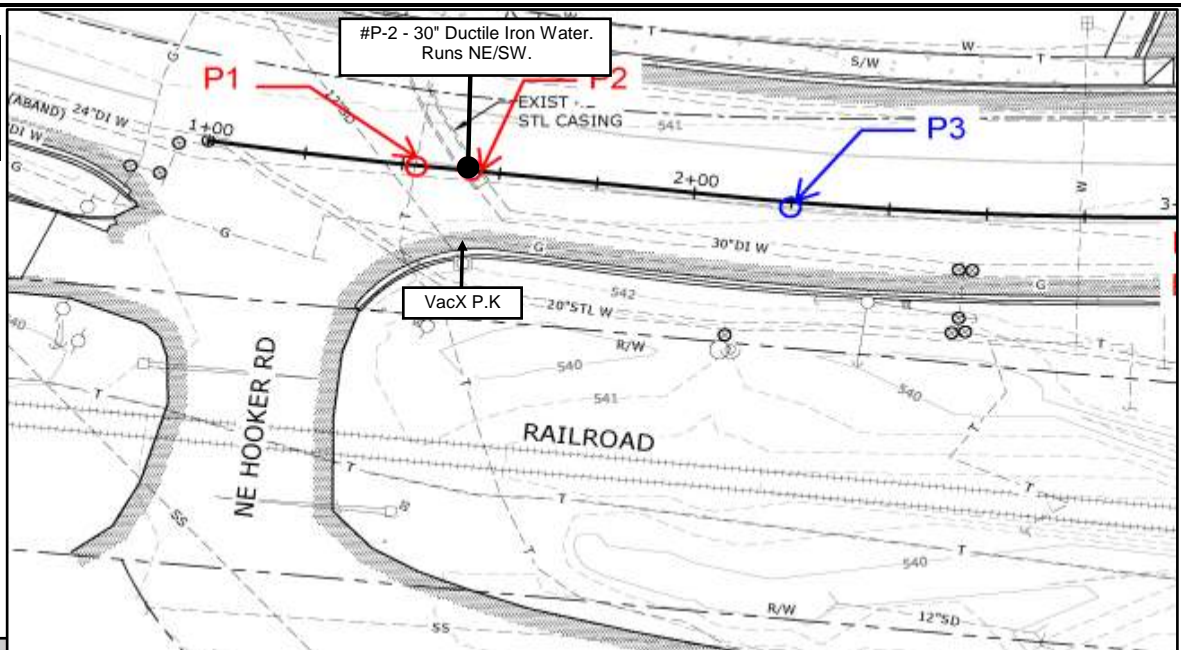
Thickness: 9" A.C.Util. material: Ductile Iron.Est Ht: 3.00 ftRemarks: P.K is inline with West curbline.Set utility tell-tale? NOEst width: 3.00 ftWe dug down on locate and got the side of the utility. Due to the size of the pipe we had to do aHoriz dist P.K to util. structure: 18.10' East of VacX P.K.VacX P.K is set at 45 degrees to utility.Approximate station location: 1+55Vertical dist P.K to top of utility: -5.94 ft.Vertical dist P.K to btm of utility: (Est) -8.94 ft.Vertical dist P.K to grnd surface: -0.69Cover depth over utility: -5.25 ft.

Sketch apparent X-section of structure:

X-section looking NORTH2nd pothole in order to get accurate measurements. We got a visual on the utility but we couldn't get a clear picture due to excess ground water.

Rod P.K	Rod Util.	Dist.
3.23	9.17	-5.94

Rod Grnd	Rod Util.	Dist.
3.92	9.17	-5.25

Prepared by: Jason Jones, VacX
(541) 505-5074 ext 109
(541) 517-0754 Cell
Email: JJ@Vacx.com

Facing East.



Facing East.



TEST HOLE REPORT SHEET

TH # P-4

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/1/2021

Utility Owner/operator: Avista
Utility type: Gas, 2" Poly.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

Thickness: 9" A.C.

Util. material: Poly.

Est Ht: 0.20 ft

Remarks: P.K is 2.00 ft East of West curbface.

Set utility tell-tale? NO

Est width: 0.20 ft

Horiz dist P.K to util. structure: 5.25' East of VacX P.K.

VacX P.K is set inline with utility.

Approximate station location: 3+36

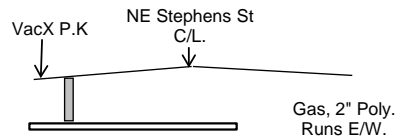
Vertical dist P.K to top of utility: -4.65 ft.

Vertical dist P.K to btm of utility: (Est) -4.85 ft.

Vertical dist P.K to grnd surface: -0.08

Cover depth over utility: -4.57 ft.

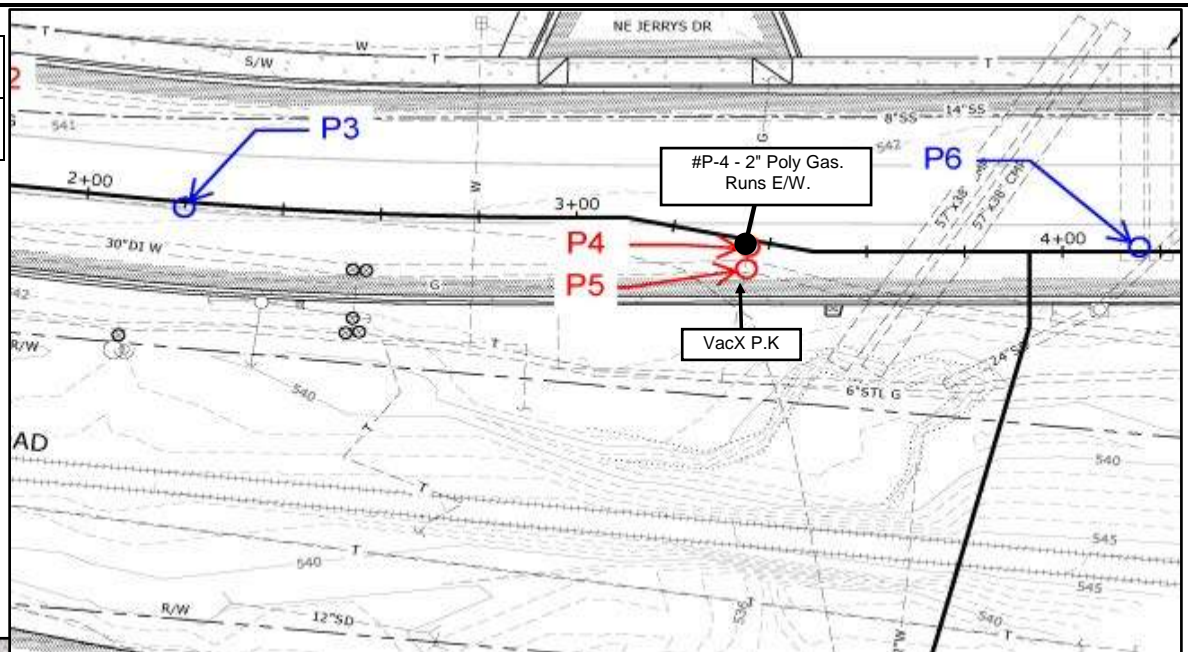
Sketch apparent X-section of structure:



X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.07	7.72	-4.65
Rod Grnd	Rod Util.	Dist.
3.15	7.72	-4.57

Prepared by: Jason Jones, VacX
(541) 505-5074 ext 109
(541) 517-0754 Cell
Email: JJ@Vacx.com



Facing East.



Facing East.



TEST HOLE REPORT SHEET

TH # P-5

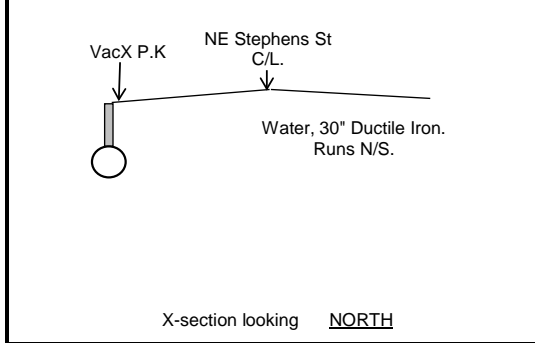
Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/4/2021

Utility Owner/operator: City of Roseburg
Utility type: Water, 30" Ductile Iron.
Pothole Location: NE Stephens St, Roseburg.

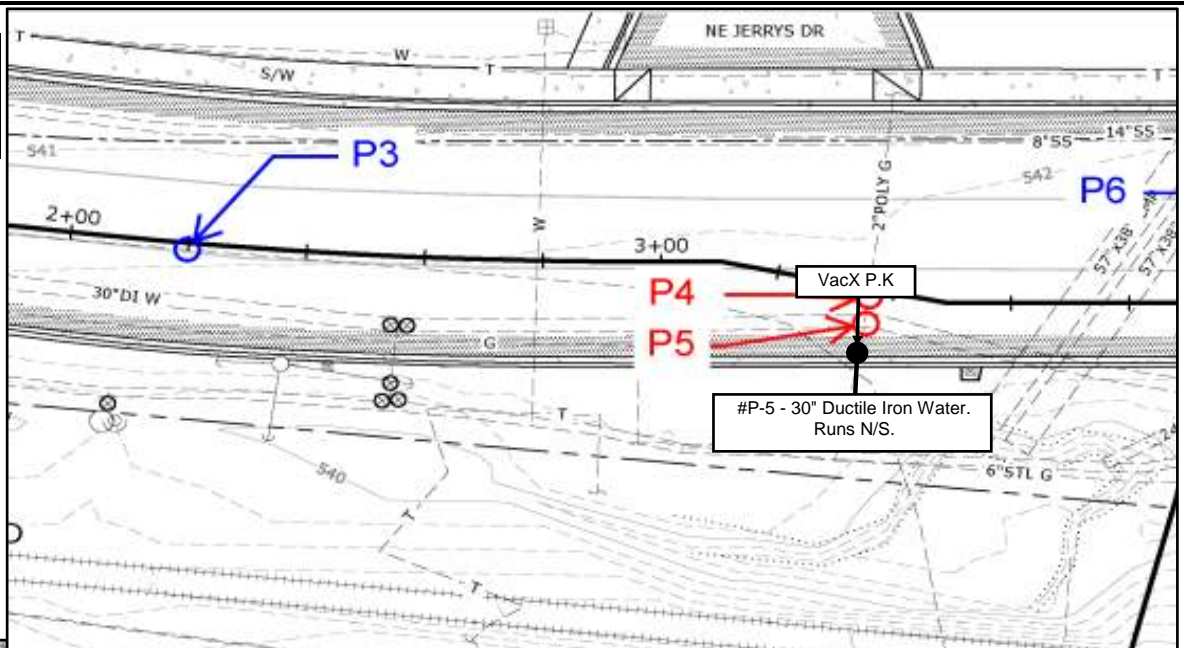
Pvmt. Core
Thickness: N/A Util. material: Ductile Iron. Est Ht: 3.00 ft Remarks: P.K is 2.00 ft East of West curbface.
Set utility tell-tale? YES Est width: 3.00 ft We were unable to get a picture of the utility due to excess ground water.
Horiz dist P.K to util. structure: 2.00' West of VacX P.K.
VacX P.K is set at 90 degrees to utility.
Approximate station location: 3+36
Vertical dist P.K to top of utility: -11.98 ft.
Vertical dist P.K to btm of utility: (Est) -14.98 ft.
Vertical dist P.K to grnd surface: 0.22
Cover depth over utility: -12.20 ft.

Sketch apparent X-section of structure:



Rod P.K	Rod Util.	Dist.
3.24	15.22	-11.98
Rod Grnd	Rod Util.	Dist.
3.02	15.22	-12.20

Prepared by: Jason Jones, VacX
(541) 505-5074 ext 109
(541) 517-0754 Cell
Email: JJ@Vacx.com



Facing West.



Facing East.



TEST HOLE REPORT SHEET

TH # P-7

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/2/2021

Utility Owner/operator: City of Roseburg
Utility type: Water, 30" Ductile Iron.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

Thickness: N/A

Util. material: Ductile Iron.

Est Ht: 3.00 ft

Remarks: P.K is 2.00 ft East of West curbface.

Set utility tell-tale? YES

Est width: 3.00 ft

Horiz dist P.K to util. structure: 18.85' West of VacX P.K.

VacX P.K is set at 90 degrees to utility.

Approximate station location: 4+90

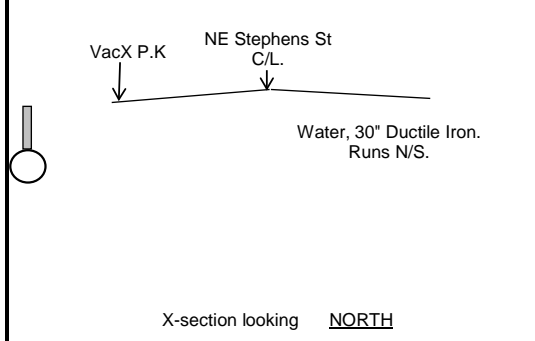
Vertical dist P.K to top of utility: -9.53 ft.

Vertical dist P.K to btm of utility: (Est) -12.53 ft.

Vertical dist P.K to grd surface: -2.42

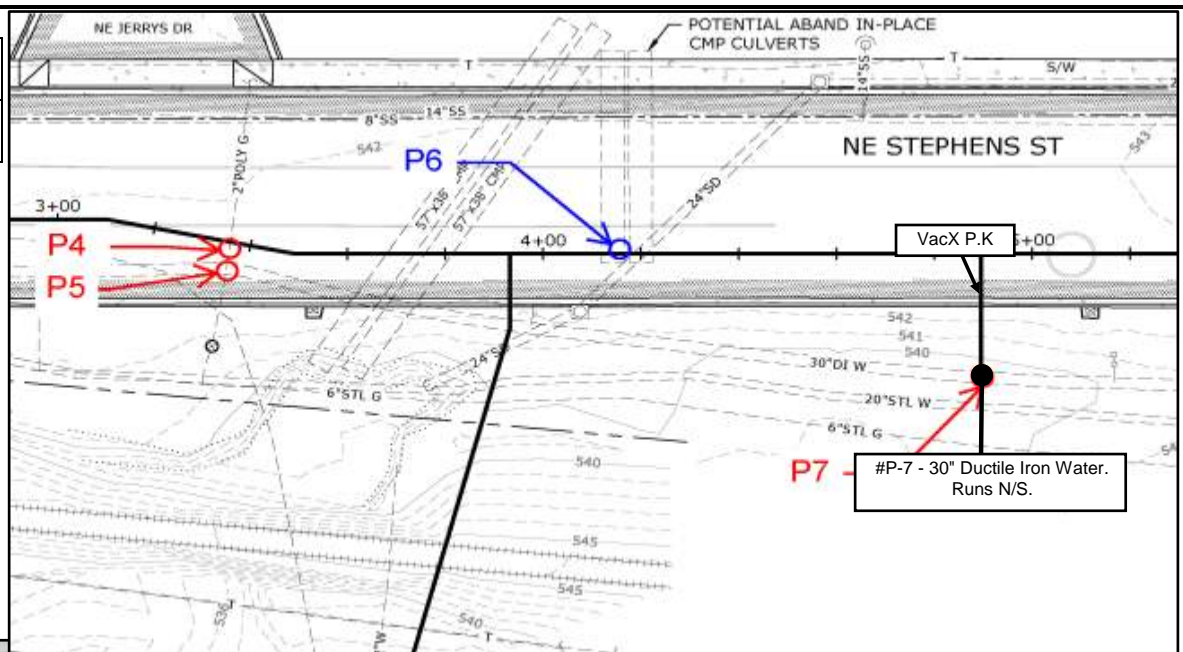
Cover depth over utility: -7.11 ft.

Sketch apparent X-section of structure:



Rod P.K	Rod Util.	Dist.
2.99	12.52	-9.53
Rod Grnd	Rod Util.	Dist.
5.41	12.52	-7.11

Prepared by: Jason Jones, VacX
(541) 505-5074 ext 109
(541) 517-0754 Cell
Email: JJ@Vacx.com



Facing West.



Facing West.



TEST HOLE REPORT SHEET

TH # P-8

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/2/2021

Utility Owner/operator: Avista
Utility type: Gas, 2" Poly.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

Thickness: 8" A.C

Util. material: Poly.

Est Ht: 0.20 ft

Remarks: P.K is 2.00 ft East of West curbface.

Set utility tell-tale? NO

Est width: 0.20 ft

Horiz dist P.K to util. structure: 6.35' East of VacX P.K.

VacX P.K is set inline with utility.

Approximate station location: 6+67

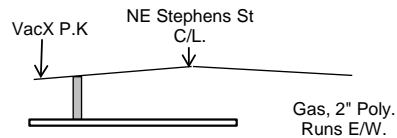
Vertical dist P.K to top of utility: -3.84 ft.

Vertical dist P.K to btm of utility: (Est) -4.04 ft.

Vertical dist P.K to grnd surface: 0.29

Cover depth over utility: -4.13 ft.

Sketch apparent X-section of structure:

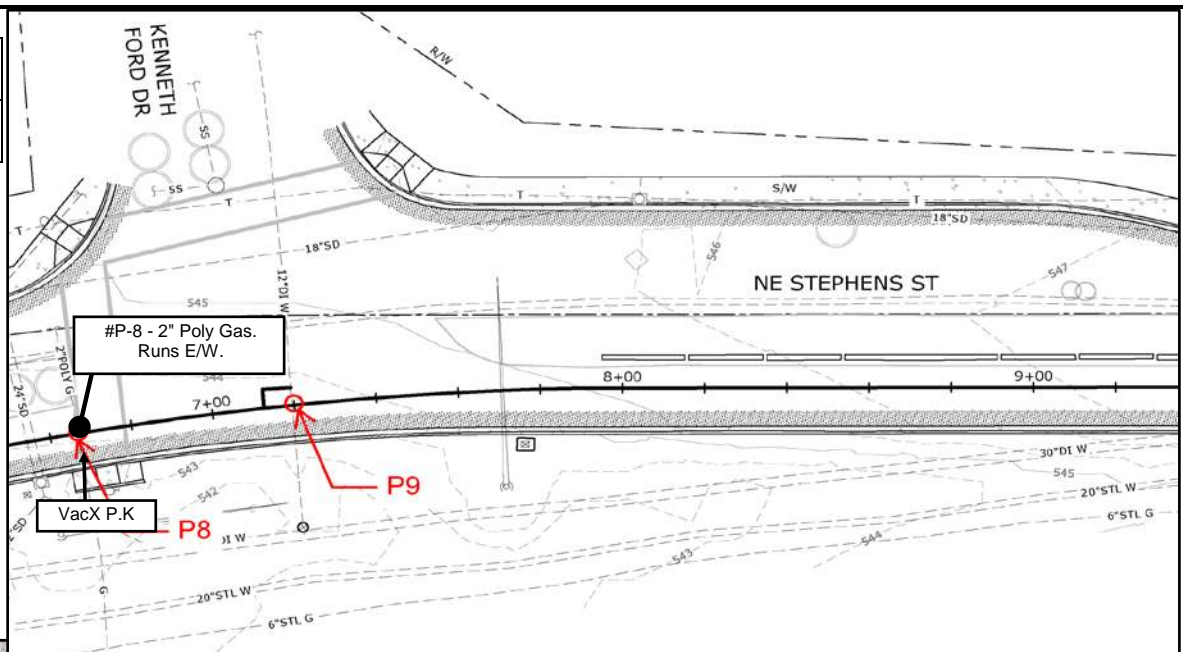


X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.45	7.29	-3.84

Rod Grnd	Rod Util.	Dist.
3.16	7.29	-4.13

Prepared by: Jason Jones, VacX
(541) 505-5074 ext 109
(541) 517-0754 Cell
Email: JJ@Vacx.com



Facing East.



Facing East.



TEST HOLE REPORT SHEET

TH # P-9

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/2/2021

Utility Owner/operator: City of Roseburg
Utility type: Water, 12" Ductile Iron.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

Thickness: 8" A.C

Util. material: Ductile Iron.

Est Ht: 1.20 ft

Remarks: P.K is 2.00 ft East of West curbface.

Set utility tell-tale? NO

Est width: 1.20 ft

Horiz dist P.K to util. structure: 7.60' East of VacX P.K.

VacX P.K is set inline with utility.

Approximate station location: 7+20

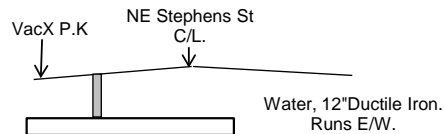
Vertical dist P.K to top of utility: -3.59 ft.

Vertical dist P.K to btm of utility: (Est) -4.79 ft.

Vertical dist P.K to grnd surface: 0.32

Cover depth over utility: -3.91 ft.

Sketch apparent X-section of structure:

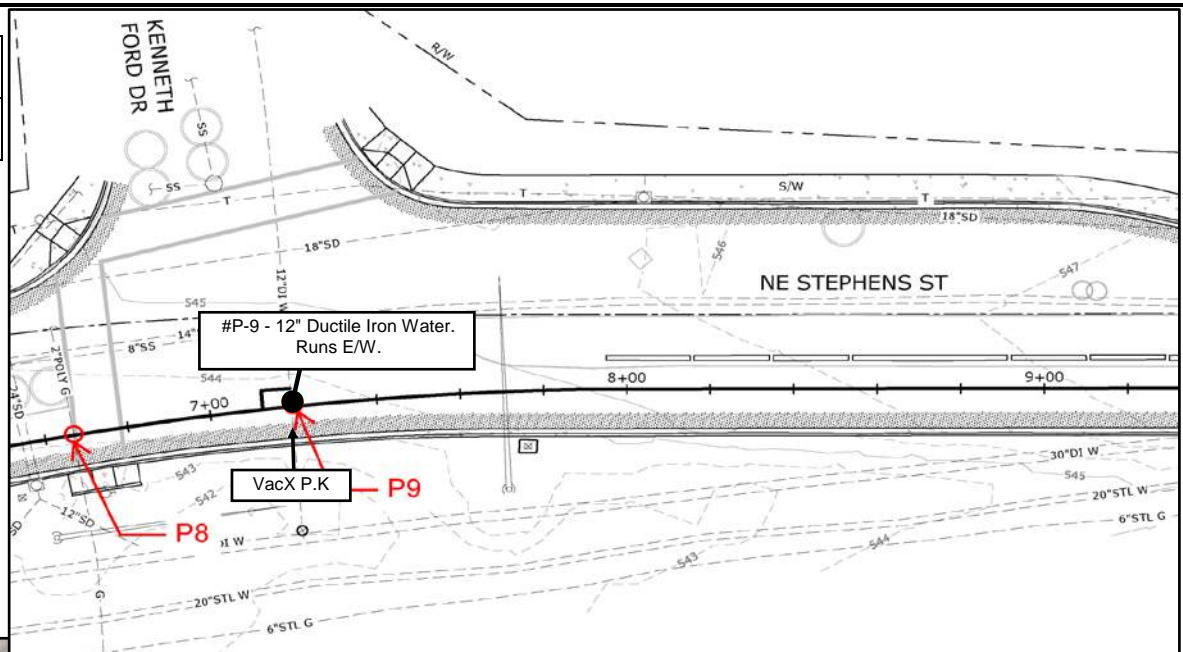


X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.51	7.10	-3.59

Rod Grnd	Rod Util.	Dist.
3.19	7.10	-3.91

Prepared by: Jason Jones, VacX
(541) 505-5074 ext 109
(541) 517-0754 Cell
Email: JJ@Vacx.com





TEST HOLE REPORT SHEET

TH # P-10

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/2/2021

Utility Owner/operator: Avista
Utility type: Gas, 2" Poly.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

Thickness: 8" A.C

Util. material: Poly.

Est Ht: 0.20 ft

Remarks: P.K is 2.00 ft East of West curbface.

Set utility tell-tale? NO

Est width: 0.20 ft

Horiz dist P.K to util. structure: 9.00' East of VacX P.K.

VacX P.K is set inline with utility.

Approximate station location: 16+83

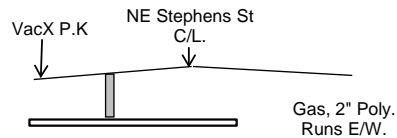
Vertical dist P.K to top of utility: -2.04 ft.

Vertical dist P.K to btm of utility: (Est) -2.24 ft.

Vertical dist P.K to grnd surface: 0.18

Cover depth over utility: -2.22 ft.

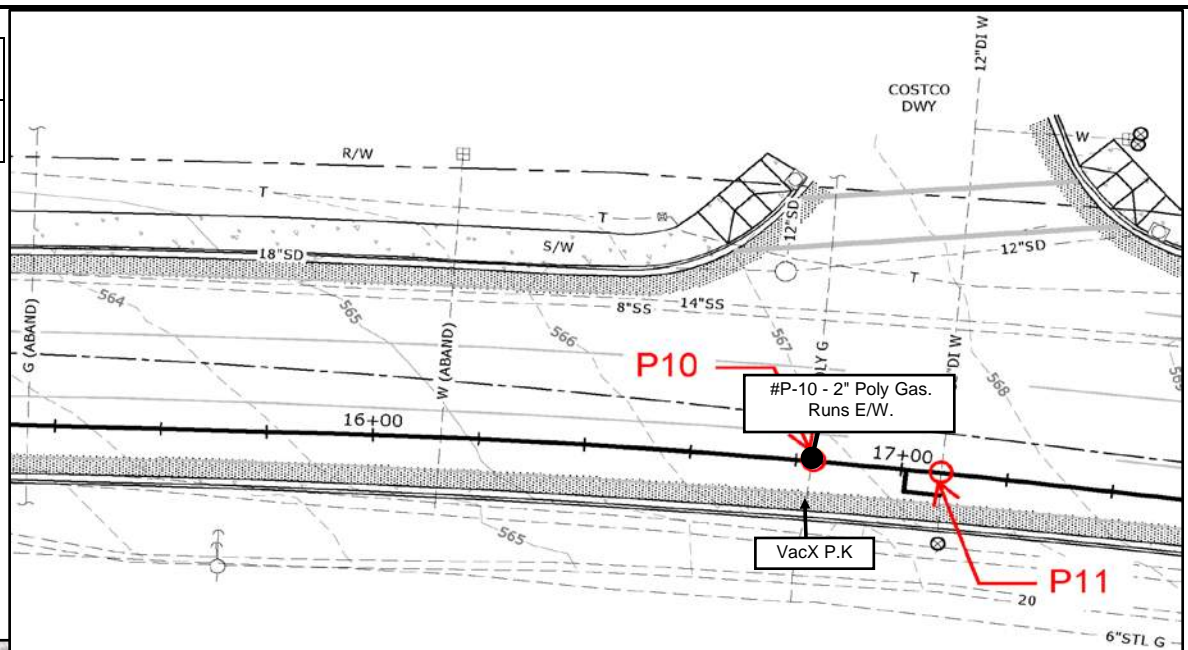
Sketch apparent X-section of structure:



X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.83	5.87	-2.04
Rod Grnd	Rod Util.	Dist.
3.65	5.87	-2.22

Prepared by: Jason Jones, VacX
(541) 505-5074 ext 109
(541) 517-0754 Cell
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TEST HOLE REPORT SHEET

TH # P-11

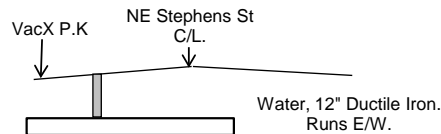
Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/2/2021

Utility Owner/operator: City of Roseburg
Utility type: Water, 12" Ductile Iron.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core
Thickness: 9" A.C Util. material: Ductile Iron. Est Ht: 1.20 ft Remarks: P.K is 2.00 ft East of West curbface.
Set utility tell-tale? NO Est width: 1.20 ft We got a visual of the utility but were unable to get a clear picture due to excess ground water.
Horiz dist P.K to util. structure: 9.25' East of VacX P.K.
VacX P.K is set inline with utility.
Approximate station location: 17+08
Vertical dist P.K to top of utility: -6.44 ft.
Vertical dist P.K to btm of utility: (Est) -7.64 ft.
Vertical dist P.K to grnd surface: 0.13
Cover depth over utility: -6.57 ft.

Sketch apparent X-section of structure:

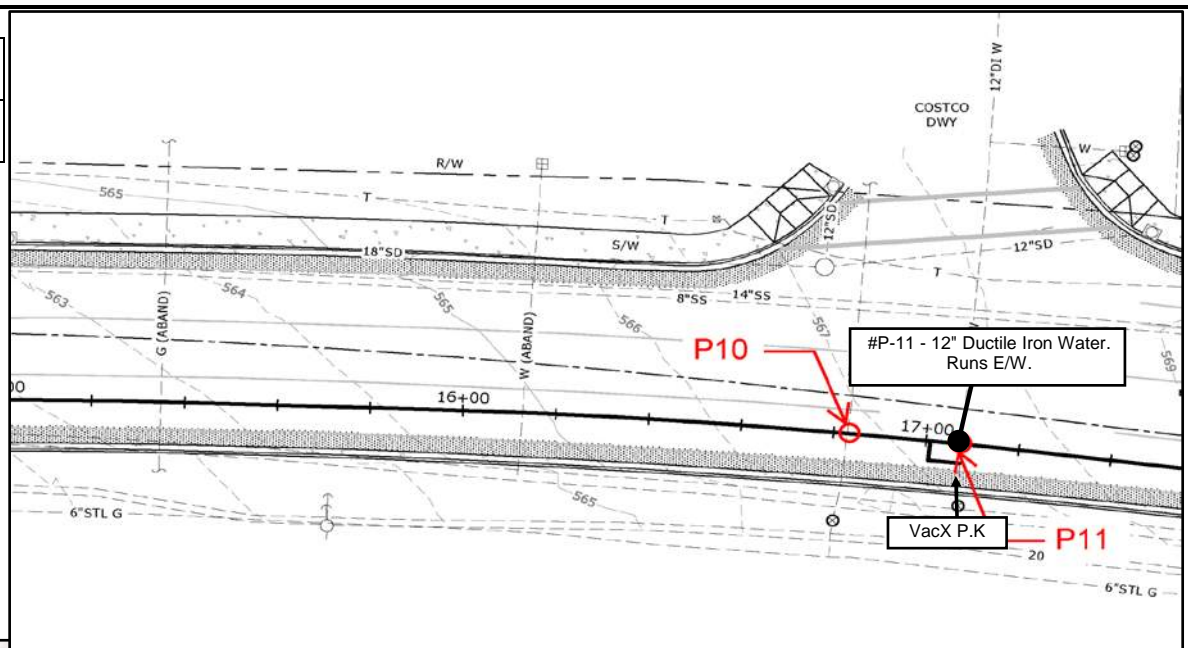


X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.21	9.65	-6.44

Rod Grnd	Rod Util.	Dist.
3.08	9.65	-6.57

Prepared by: Jason Jones, VacX
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Email: JJ@Vacx.com



Facing East.



Facing East.



TEST HOLE REPORT SHEET

TH # P-12

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/2/2021

Utility Owner/operator: Avista
Utility type: Gas, 2" Poly.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

Thickness: 7" A.C

Util. material: Poly.

Est Ht: 0.20 ft

Remarks: P.K is 2.00 ft East of West curbface.

Set utility tell-tale? NO

Est width: 0.20 ft

Horiz dist P.K to util. structure: 9.30' East of VacX P.K.

VacX P.K is set inline with utility.

Approximate station location: 20+92

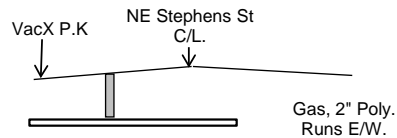
Vertical dist P.K to top of utility: -5.56 ft.

Vertical dist P.K to btm of utility: (Est) -5.76 ft.

Vertical dist P.K to grnd surface: 0.15

Cover depth over utility: -5.71 ft.

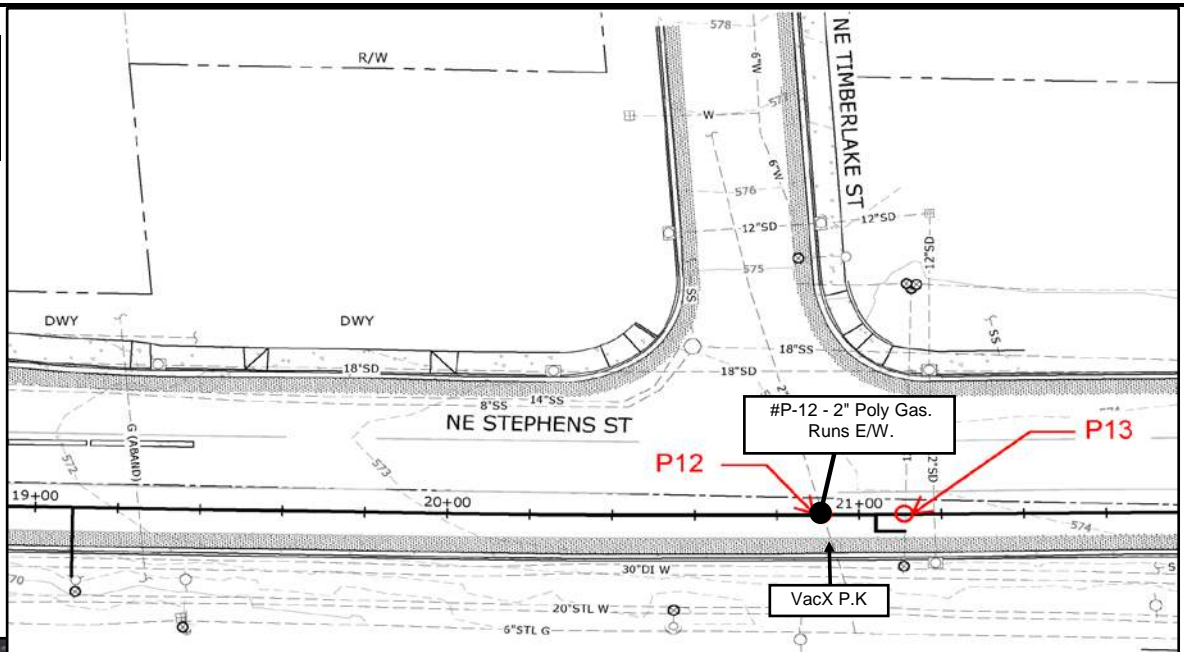
Sketch apparent X-section of structure:



X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.28	8.84	-5.56
Rod Grnd	Rod Util.	Dist.
3.13	8.84	-5.71

Prepared by: Jason Jones, VacX
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(541) 517-0754 Cell
Email: JJ@Vacx.com



Facing East.



Facing East.



TEST HOLE REPORT SHEET

TH # P-13

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/2/2021

Utility Owner/operator: City of Roseburg
Utility type: Water, 12" Ductile Iron.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

Thickness: 8" A.C

Util. material: Ductile Iron.

Est Ht: 1.20 ft

Remarks: P.K is 2.00 ft East of West curbface.

Set utility tell-tale? NO

Est width: 1.20 ft

Horiz dist P.K to util. structure: 9.80' East of VacX P.K.

VacX P.K is set inline with utility.

Approximate station location: 21+11

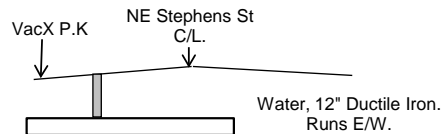
Vertical dist P.K to top of utility: -6.96 ft.

Vertical dist P.K to btm of utility: (Est) -8.16 ft.

Vertical dist P.K to grd surface: 0.14

Cover depth over utility: -7.10 ft.

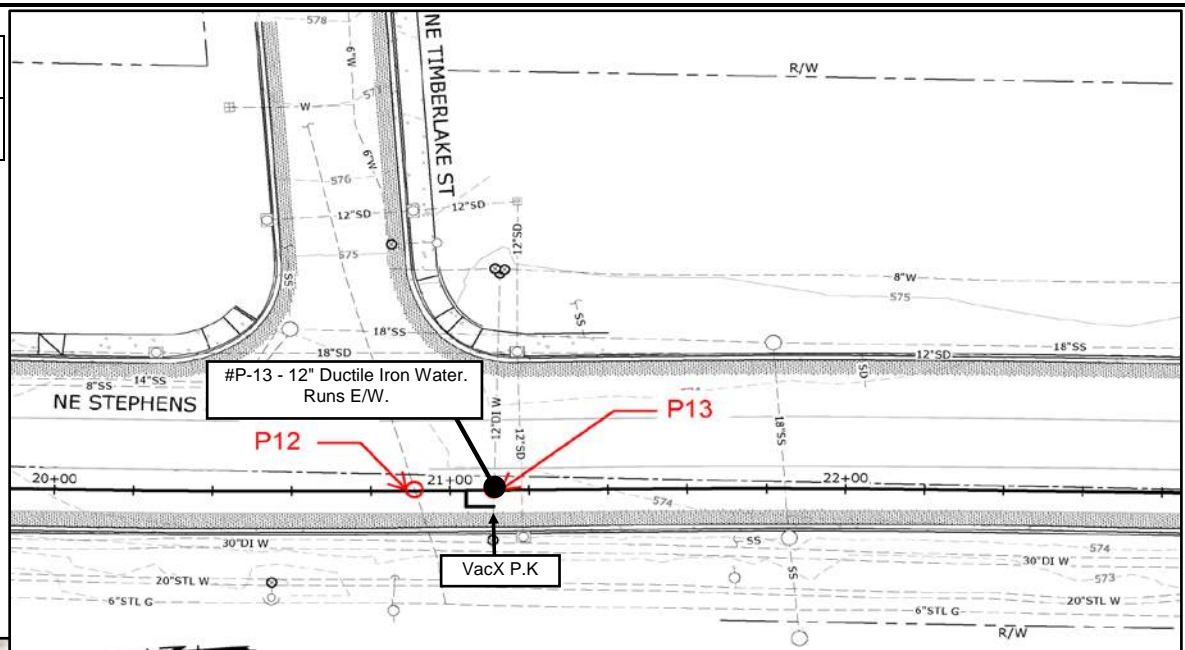
Sketch apparent X-section of structure:



X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.88	10.84	-6.96
Rod Grnd	Rod Util.	Dist.
3.74	10.84	-7.10

Prepared by: Jason Jones, VacX
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Facing East.



Facing East.



TEST HOLE REPORT SHEET

TH # P-14

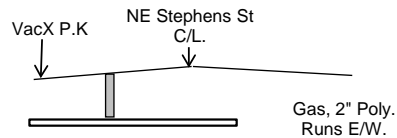
Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/4/2021

Utility Owner/operator: Avista
Utility type: Gas, 2" Poly.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core
Thickness: 7" A.C. Util. material: Poly. Est Ht: 0.20 ft Remarks: P.K is 2.00 ft East of West curbface.
Set utility tell-tale? NO Est width: 0.20 ft Both the map and pothole list show this as a 2" steel, but we found a 2" Poly.
Horiz dist P.K to util. structure: 8.85' East of VacX P.K.
VacX P.K is set inline with utility.
Approximate station location: 23+29
Vertical dist P.K to top of utility: -5.20 ft.
Vertical dist P.K to btm of utility: (Est) -5.40 ft.
Vertical dist P.K to grnd surface: 0.21
Cover depth over utility: -5.41 ft.

Sketch apparent X-section of structure:

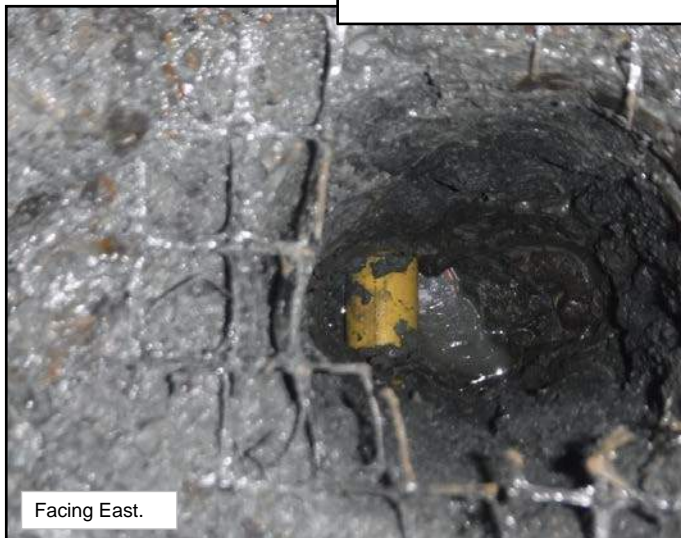
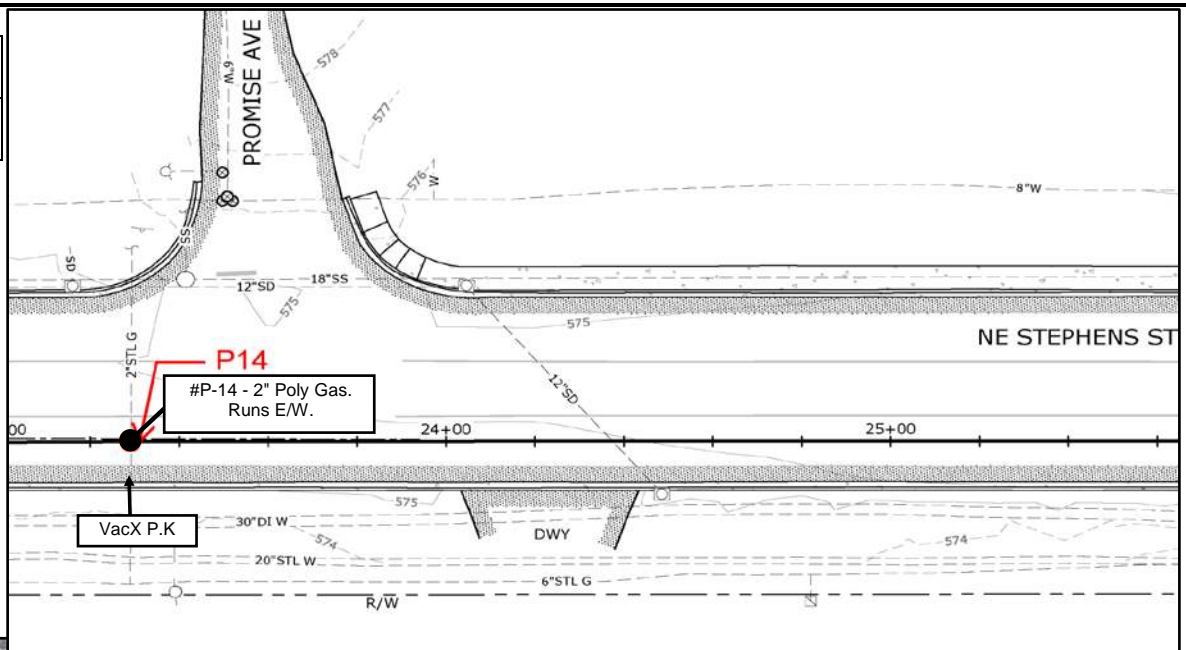


X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.76	8.96	-5.20

Rod Grnd	Rod Util.	Dist.
3.55	8.96	-5.41

Prepared by: Jason Jones, VacX
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Facing East.



Facing East.



TEST HOLE REPORT SHEET

TH # P-15

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/4/2021

Utility Owner/operator: Avista
Utility type: Gas, 1.25" Poly.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

Thickness: 7" A.C

Util. material: Poly.

Est Ht: 0.12 ft

Remarks: P.K is 2.00 ft East of West curbface.

Set utility tell-tale? NO

Est width: 0.12 ft

Horiz dist P.K to util. structure: 9.10' East of VacX P.K.

VacX P.K is set inline with utility.

Approximate station location: 26+67

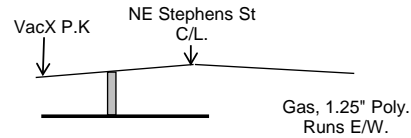
Vertical dist P.K to top of utility: -7.47 ft.

Vertical dist P.K to btm of utility: (Est) -7.59 ft.

Vertical dist P.K to grnd surface: 0.13

Cover depth over utility: -7.60 ft.

Sketch apparent X-section of structure:

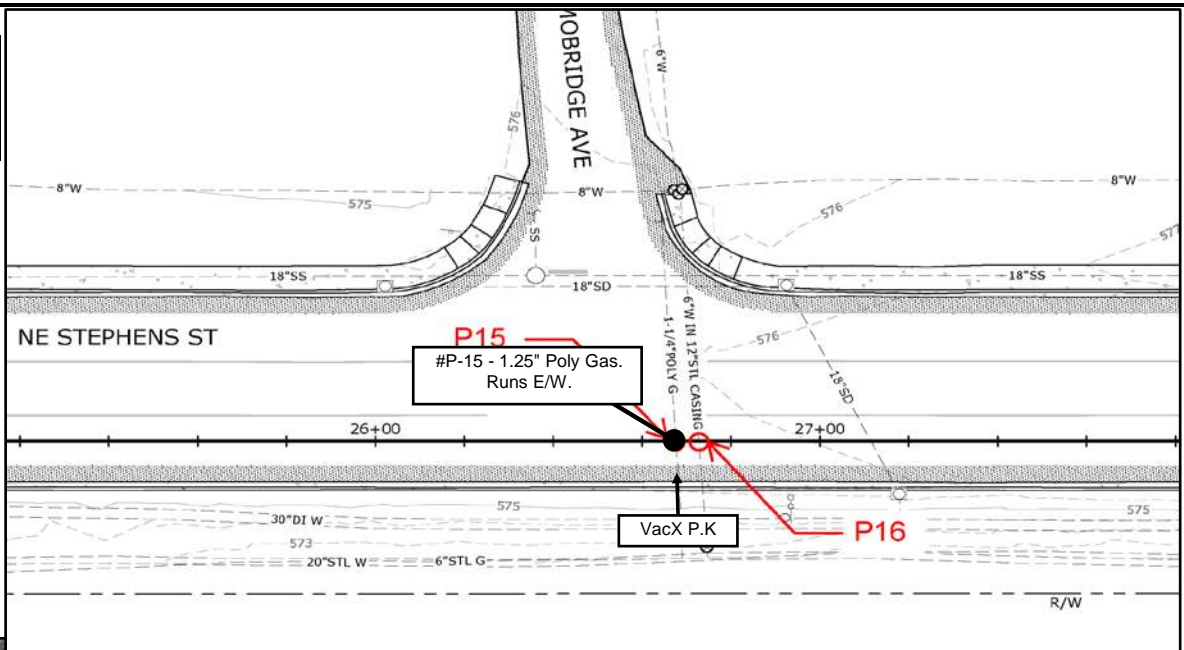


X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.82	11.29	-7.47

Rod Grnd	Rod Util.	Dist.
3.69	11.29	-7.60

Prepared by: Jason Jones, VacX
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Email: JJ@Vacx.com



Facing East.



Facing East.



TEST HOLE REPORT SHEET

TH # P-16

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/4/2021

Utility Owner/operator: City of Roseburg
Utility type: Water, 6" in 12" Steel Casing.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

Thickness: 7" A.C

Util. material: Steel.

Est Ht: 1.20 ft

Remarks: P.K is 2.00 ft East of West curbface.

Set utility tell-tale? NO

Est width: 1.20 ft

Horiz dist P.K to util. structure: 8.90' East of VacX P.K.

VacX P.K is set inline with utility.

Approximate station location: 26+73

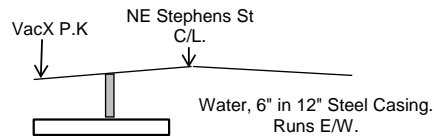
Vertical dist P.K to top of utility: -9.00 ft.

Vertical dist P.K to btm of utility: (Est) -10.20 ft.

Vertical dist P.K to grnd surface: 0.14

Cover depth over utility: -9.14 ft.

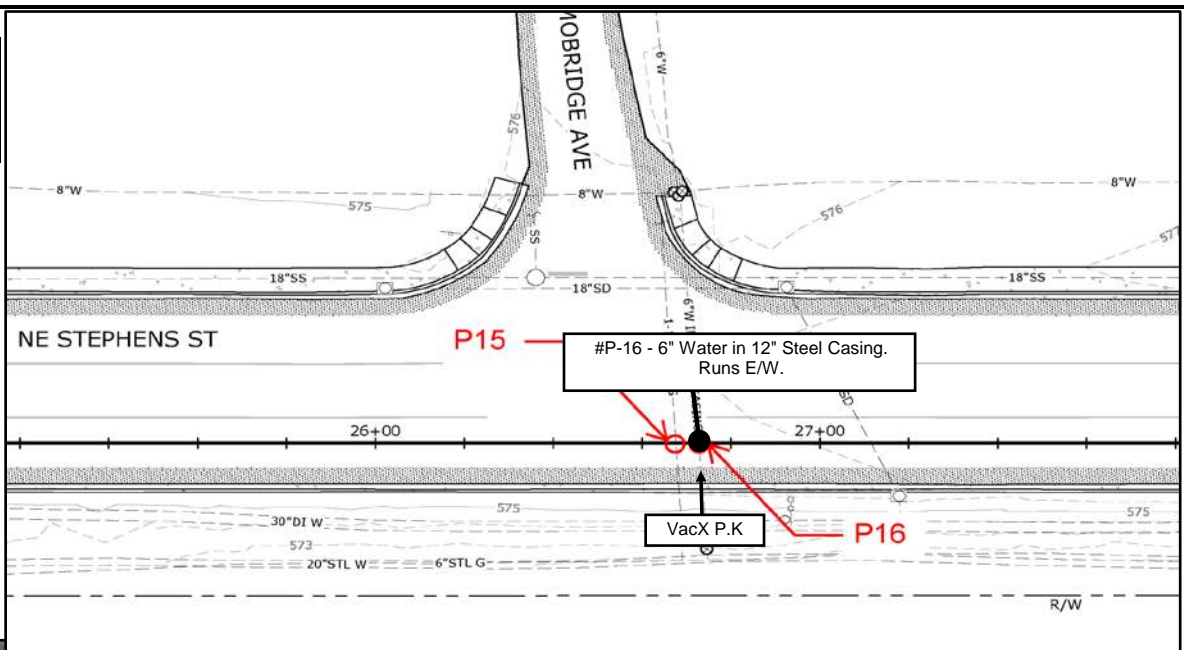
Sketch apparent X-section of structure:



X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.22	12.22	-9.00
Rod Grnd	Rod Util.	Dist.
3.08	12.22	-9.14

Prepared by: Jason Jones, VacX
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(541) 517-0754 Cell
Email: JJ@Vacx.com





TEST HOLE REPORT SHEET

TH # P-17

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/4/2021

Utility Owner/operator: Avista
Utility type: Gas, 2" Poly.
Pothole Location: NE Stephens St, Roseburg.

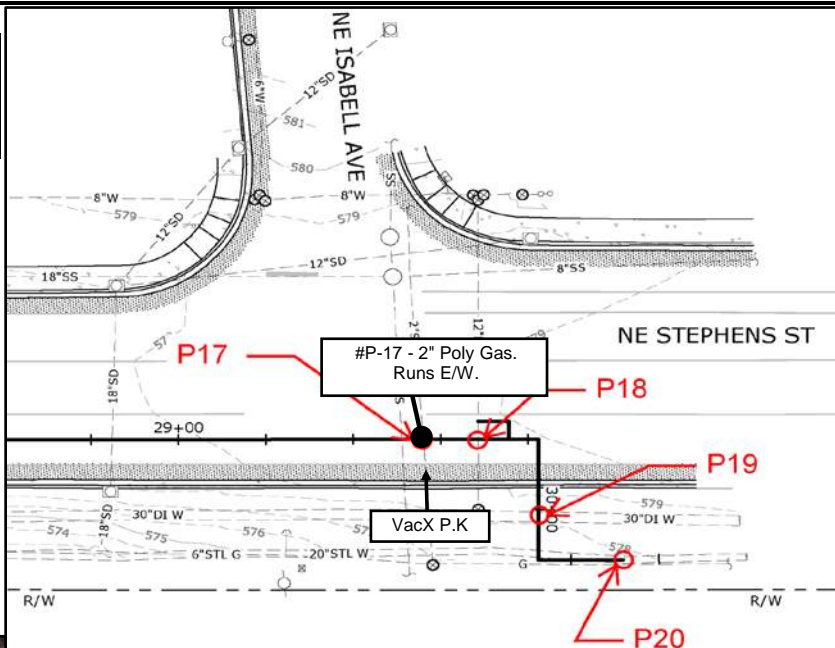
Pvmt. Core
Thickness: 8" A.C Util. material: Poly. Est Ht: 0.20 ft Remarks: P.K is 2.00 ft East of West curbface.
Set utility tell-tale? NO Est width: 0.20 ft The map and list show this as a 2" steel gas, but it appears to be a 2" Poly.
Horiz dist P.K to util. structure: 9.20' East of VacX P.K.
VacX P.K is set inline with utility.
Approximate station location: 29+56
Vertical dist P.K to top of utility: -8.10 ft.
Vertical dist P.K to btm of utility: (Est) -8.30 ft.
Vertical dist P.K to grnd surface: 0.11
Cover depth over utility: -8.21 ft.

Sketch apparent X-section of structure:

X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.61	11.71	-8.10
Rod Grnd	Rod Util.	Dist.
3.50	11.71	-8.21

Prepared by: Jason Jones, VacX
(541) 505-5074 ext 109
(541) 517-0754 Cell
Email: JJ@Vacx.com



P17: 2" Steel Gas
P18: 12" DI W, Cr
P19: 30" DI W, Cr
P20: 20" Steel W,





TEST HOLE REPORT SHEET

TH # P-18

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/4/2021

Utility Owner/operator: City of Roseburg
Utility type: Water, 12" Ductile Iron.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

Thickness: 7" A.C

Util. material: Ductile Iron.

Est Ht: 1.20 ft

Remarks: P.K is 2.00 ft East of West curbface.

Set utility tell-tale? NO

Est width: 1.20 ft

Horiz dist P.K to util. structure: 9.15' East of VacX P.K.

VacX P.K is set inline with utility.

Approximate station location: 29+69

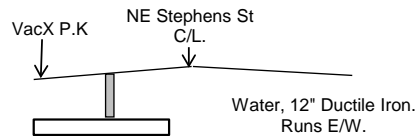
Vertical dist P.K to top of utility: -5.98 ft.

Vertical dist P.K to btm of utility: (Est) -7.18 ft.

Vertical dist P.K to grd surface: 0.12

Cover depth over utility: -6.10 ft.

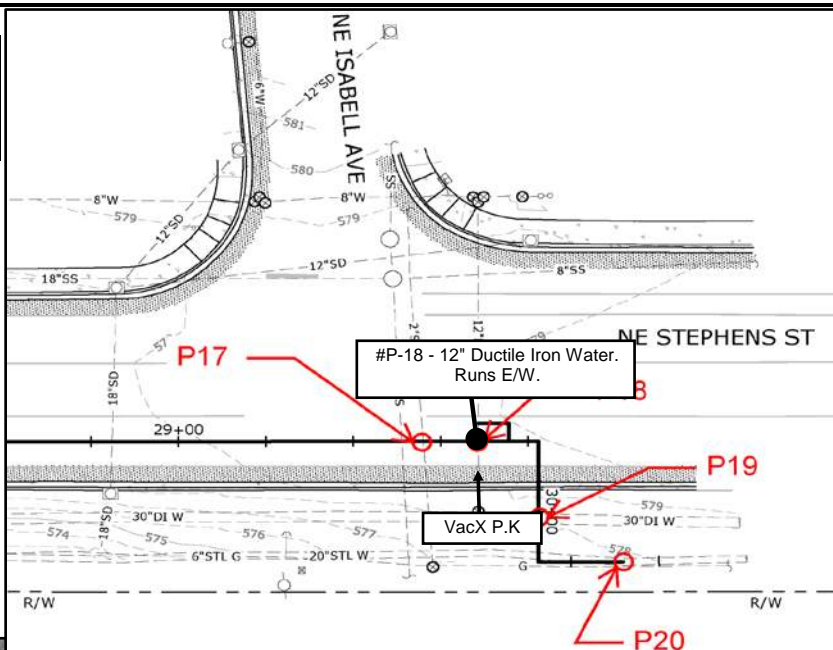
Sketch apparent X-section of structure:



X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.48	9.46	-5.98
Rod Grnd	Rod Util.	Dist.
3.36	9.46	-6.10

Prepared by: Jason Jones, VacX
(541) 505-5074 ext 109
(541) 517-0754 Cell
Email: JJ@Vacx.com



P17: 2" Steel Gas
P18: 12" DI W, Cr
P19: 30" DI W, Cr
P20: 20" Steel W,



Facing East.



Facing East.



TEST HOLE REPORT SHEET

TH # P-19

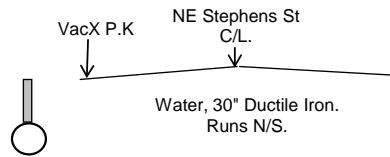
Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/4/2021

Utility Owner/operator: City of Roseburg
Utility type: Water, 30" Ductile Iron.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core
Thickness: N/A Util. material: Ductile Iron. Est Ht: 3.00 ft Remarks: P.K is 2.00 ft East of West curbface.
Set utility tell-tale? YES Est width: 3.00 ft The waterline has some sort of wrap on it at this location.
Horiz dist P.K to util. structure: 10.55' West of VacX P.K.
VacX P.K is set at 90 degrees to utility.
Approximate station location: 30+01
Vertical dist P.K to top of utility: -5.99 ft.
Vertical dist P.K to btm of utility: (Est) -8.99 ft.
Vertical dist P.K to grd surface: -0.55
Cover depth over utility: -5.44 ft.

Sketch apparent X-section of structure:

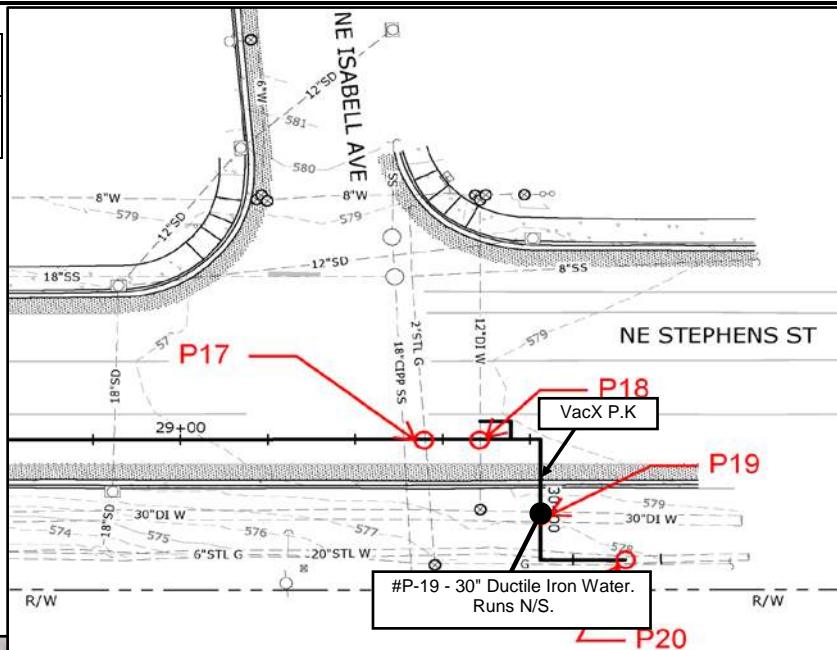


X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.39	9.38	-5.99

Rod Grnd	Rod Util.	Dist.
3.94	9.38	-5.44

Prepared by: Jason Jones, VacX
(541) 505-5074 ext 109
(541) 517-0754 Cell
Email: JJ@Vacx.com



P17: 2" Steel Gas
P18: 12" DI W, Cr
P19: 30" DI W, Cr
P20: 20" Steel W,



Facing West.



Facing West.



TEST HOLE REPORT SHEET

TH # P-20

Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/4/2021

Utility Owner/operator: City of Roseburg
Utility type: Water, 20" Steel.
Pothole Location: NE Stephens St, Roseburg.

Pvmt. Core

Thickness: N/A

Util. material: Steel.

Est Ht: 2.00 ft

Remarks: P.K is 2.00 ft East of West curbface.

Set utility tell-tale? YES

Est width: 2.00 ft

Horiz dist P.K to util. structure: 19.80' West of VacX P.K.

VacX P.K is set at 90 degrees to utility.

Approximate station location: 30+32

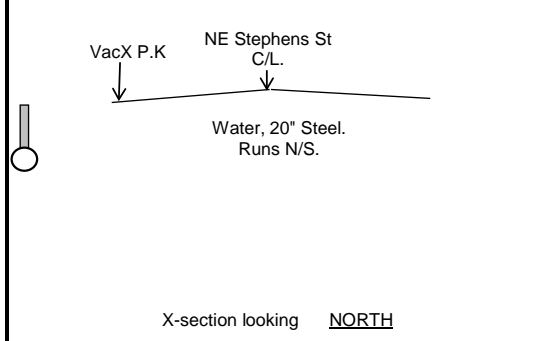
Vertical dist P.K to top of utility: -7.47 ft.

Vertical dist P.K to btm of utility: (Est) -9.47 ft.

Vertical dist P.K to grd surface: -1.07

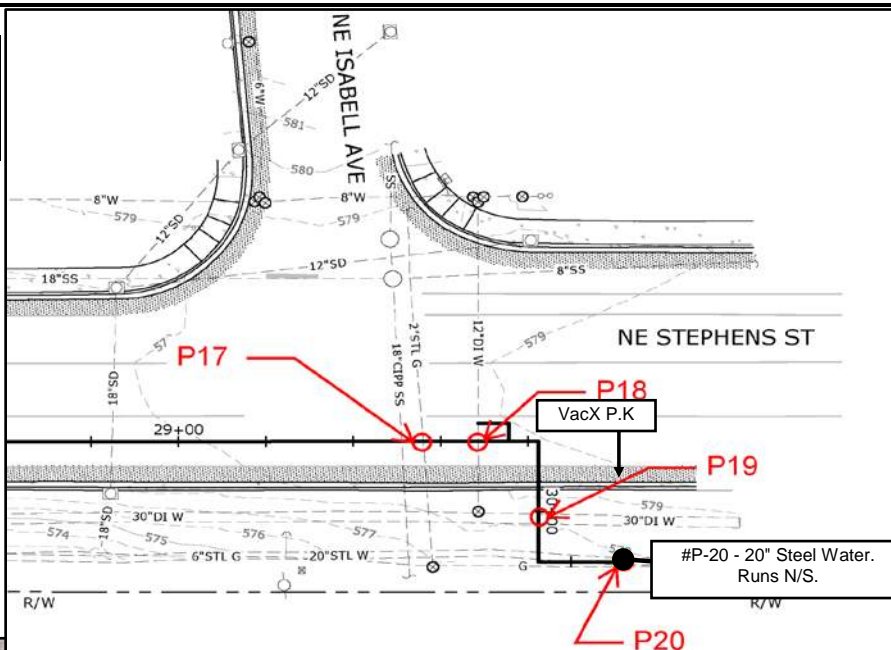
Cover depth over utility: -6.40 ft.

Sketch apparent X-section of structure:



Rod P.K	Rod Util.	Dist.
3.21	10.68	-7.47
Rod Grnd	Rod Util.	Dist.
4.28	10.68	-6.40

Prepared by: Jason Jones, VacX
(541) 505-5074 ext 109
(541) 517-0754 Cell
Email: JJ@Vacx.com



P17: 2" Steel Gas
P18: 12" DI W, Cr
P19: 30" DI W, Cr
P20: 20" Steel W,

#P-20 - 20" Steel Water.
Runs N/S.



Facing West.



Facing West.



TEST HOLE REPORT SHEET

TH # P-21

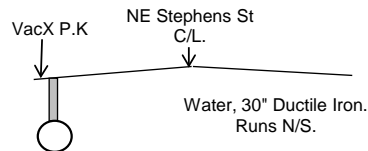
Utility Coordination Service
(888) 429-VacX

VacX # V21-10604
Customer: MurraySmith
Date: 3/4/2021

Utility Owner/operator: City of Roseburg
Utility type: Water, 30" Ductile Iron.
Pothole Location: NE Stephens St. Roseburg.

Pvmt. Core
Thickness: 9" A.C Util. material: Ductile Iron. Est Ht: 3.00 ft Remarks: P.K is 2.00 ft East of West curbface.
Set utility tell-tale? NO Est width: 3.00 ft We were unable to get a picture of the utility due to excess ground water.
Horiz dist P.K to util. structure: 1.60' East of VacX P.K.
VacX P.K is set at 90 degrees to utility.
Approximate station location: 12+61
Vertical dist P.K to top of utility: -7.83 ft.
Vertical dist P.K to btm of utility: (Est) -10.83 ft.
Vertical dist P.K to grnd surface: 0.02
Cover depth over utility: -7.85 ft.

Sketch apparent X-section of structure:

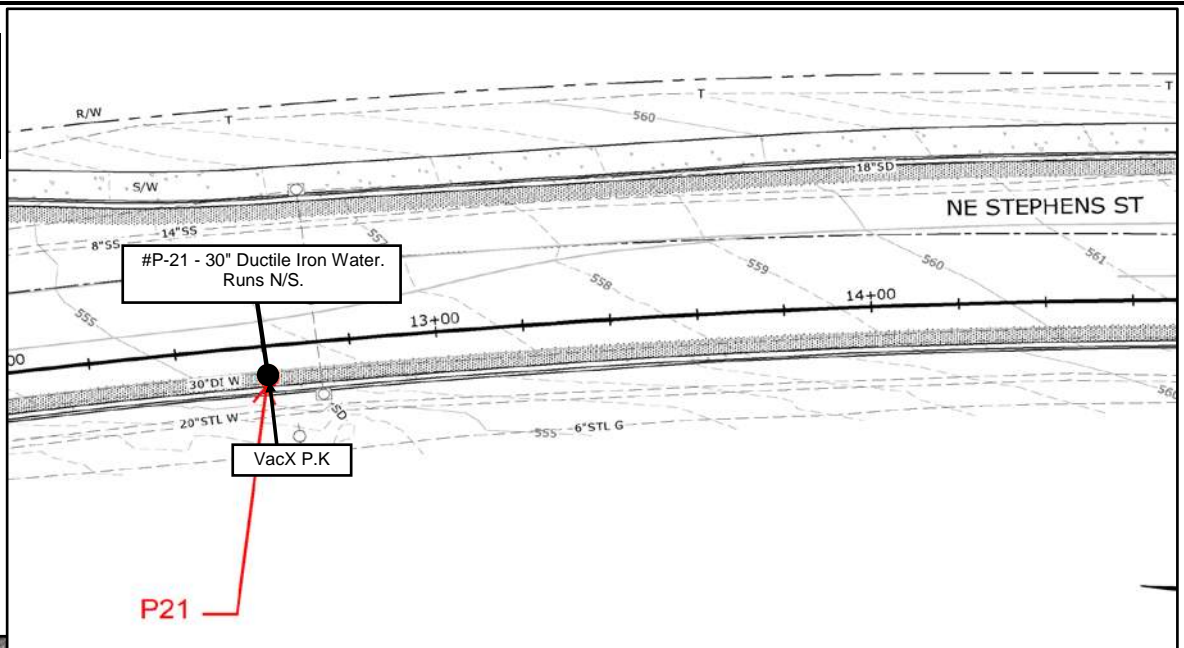


X-section looking NORTH

Rod P.K	Rod Util.	Dist.
3.66	11.49	-7.83

Rod Grnd	Rod Util.	Dist.
3.64	11.49	-7.85

Prepared by: Jason Jones, VacX
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(541) 517-0754 Cell
Email: JJ@Vacx.com



P21



Facing West.



Facing West.