Crystal Clear SUD

Approved Equipment List (AEL)

Below is a list of Crystal Clear SUD (CCSUD) approved brands for use in the Distribution and Collection system.

Brands

Air Relief Valves: Empire Controls, Val-matic, Apco

Corporation Stops: Ford, Mueller

Curb Stops: Ford, Mueller

Fire Hydrants: American, Mueller Company, EJ

Gate Valves: Mueller Company, American Cast Iron Pipe Company, EJ Group, Inc., Clow Valve Company

Restraining Joints: EBAA Iron Inc., Star Pipe Products, SIP

Service Saddles: Smith-Blair, Ford, Mueller, JCM Industries

Tapping Sleeves: Smith-Blair, Mueller

Tapping Valves: American, Mueller

Meters: Kamstrup

Meter Boxes: DFW Plastics, NDS Meter Boxes

VFD: Yaskawa

Vertical Turbine Pump: HydroFlo

Motors: TECO or US Motor

Any equipment to be installed in the CCSUD Distribution or Collection systems must come from the list above. Any equipment installed that is not listed above must be approved by the CCSUD inspector or a CCSUD Manager or the installation is subject to a failed inspection until the correct brand can be installed. If you have any questions about these procedures please contact the CCSUD Inspector.

SECTION 00500

SUBMITTALS

PART 1 - GENERAL

1.1 SCOPE

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Contractor's construction schedule.
2. Submittal schedule.
3. Shop drawings.
4. Product data.
5. Quality assurance and quality control submittals, including calculations, mix designs and substantiating test results.

B. Each item provided shall be provided and submitted in PDF format only.

C. Submittals shall meet requirements within this Section. Submittals that don't allow for thorough review will result in rejection at the Contractor's responsibility.

PART 2 – EXECUTION

2.1 SUBMITTAL PROCEDURES

A. Coordination

1. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid the need to delay installation because of the time required to process submittals. Allow sufficient time for submittal review, including times for resubmittals.
2. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
3. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals or resubmittals concurrently. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are receives.

B. Processing

1. Allow fourteen (14) calendar days for initial review. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals.
2. If an intermediate submittal is necessary, process the same as the initial submittal.

3. Allow fourteen (14) calendar days for processing each resubmittal.

4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

5. The Contractor is to review shop drawings, product data and samples prior to submission to determine and verify the following.

    a. Field measurements

    b. Field construction criteria

    c. Conformance with the Specifications

6. Each shop drawing, working drawing sample and catalog data submitted by the Contractor shall have the following Certification Statement affixed to it, signed by the Contractor:

    a. “By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract Document requirements.”

    b. All Submittals without the Certification Statement will not be reviewed and will be returned to the Contractor for proper submission.

7. No portion of the Work requiring a shop drawing, sample or catalog data is to be started nor any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased, or on-site construction accomplished which does not conform to the approved shop drawings and data to be at Contractor’s risk. The Owner shall not be liable for any expense or delay due to corrections or remedies to accomplish conformity.

8. Notify the Engineer in writing, at the time of submittal, of any deviations in the submittal(s) from the requirements as specified within the Contract Documents.

9. The review and approval of submittals by the Engineer does not relieve the Contractor from his responsibility about the fulfillment of the terms of the Contract. All risks of error and omission in submittals prepared by Contractor are assumed by the Contractor and the Engineer shall have no responsibility, therefore.

C. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space on the label or beside the title block on Shop Drawings to record the Contractor’s review and approval markings and the action taken.

2. Include the following applicable information on the label for processing and recording action taken.

    a. Project name.

b. Date.

c. Name and address of the Contractor.

d. Name and address of the supplier.

e. Name of the manufacturer.

f. Number and title of appropriate Specification Section.

g. Drawing number and detail references, as appropriate.

D. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Engineer using a transmittal form. The Engineer will not accept submittals received from sources other than Contractor.

1. Number transmittals in sequence for each Series of the Specifications thus: SD-xxxx. The number after the dash indicates the Section of the Specification. For example, the first item submitted related to Section 01230 – Excavation and Backfill would be labeled **SD-01230**. Identify resubmittals with numbering identification such as SD-xxxx-1, SD-xxxx-2, etc. For example, the first resubmittal submitted for Section 01230 – Excavation and Backfill would be labeled **SD-01230-1**.

2. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with the Drawing's requirements.

2.2 CONSTRACTOR'S PROGRESS SCHEDULE

A. Submit the Progress Schedule in accordance with the Contract Documents under the General Conditions.

2.3 SCHEDULE OF VALUES

A. Submit the Schedule of Values in accordance with the Contract Documents under the General Conditions.

2.4 SUBMITTAL SCHEDULE

A. Concurrently with the development of the Contractor's Progress Schedule, prepare a complete schedule of submittals. Submit the initial Submittal Schedule along with the Progress Schedule, at, or prior to, the Pre-construction Conference. Provide copies to Engineer, Owner, subcontractors, and other parties required to comply with submittal dates indicated.

1. Submit the Submittal Schedule in accordance with the Contract Documents under the General Conditions.

2. Coordinate Submittal Schedule with the list of subcontractors, Schedule of Values, and the list of products as well as the Contractor's Progress Schedule.

B. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule

concurrently with the report of each meeting, or as requested by the Engineer.

2.5 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, circle, or otherwise indicate deviations from the Specifications. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Drawings is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:

1. Dimensions;
2. Identifications of products and materials include by sheet and detail number;
3. Compliance with specified standards;
4. Notation of coordination requirements; and
5. Notation of dimensions established by field measurement.
6. Sheet size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets 8-1/2 inches by 11 inches.
7. Do not use Shop Drawings without an appropriate stamp indicating action taken.

2.6 PRODUCT DATA

A. Collect product data into a single submittal for each element of construction or system. Product data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, applicable certifications, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed product data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
    a. Manufacturer's printed recommendations;
    b. Compliance with trade association standards;
    c. Compliance with recognized testing agency standards;
    d. Application of testing agency labels and seals;
    e. Notation of dimensions verified by field measurement; and
    f. Notation of coordination requirements.
2. Do not submit product data until compliance with requirements of the Contract Documents has been confirmed.

2.7 QUALITY ASSURANCE AND QUALITY CONTROL SUBMITTALS

A. Submit quality assurance and quality control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, materials test results, field testing and inspection reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a certification from the manufacturer or responsible Engineer certifying compliance with specified requirements.

1. Mark Signature: Certification shall be signed by an officer of the corporation or other individual authorized to sign documents on behalf of the company.

C. Calculations: When required in the Specifications, calculations shall be prepared and stamped by a Professional Engineer registered in the State of Texas.

D. Concrete, Controlled Low Strength Material, Asphalt Stabilized Base and Hot Mix Asphaltic Concrete Mix Designs and Substantiating Test Data. Requirements for submittal of mix designs and substantiating test data are specified in the applicable Technical Specification Section. Each separate batch plant supplying ASB, HMAC and/or concrete shall submit mix designs to the Engineer for review.

2.8 ENGINEER'S ACTION

A. Except for submittals, for the record, or for information where action and return is not required, the Engineer will review each submittal, mark to indicate action taken, and return within the time frame specified in Paragraph 2.1.B of this Section.

B. Action Stamp: The Engineer will provide its Submittal Review template and mark the stamp appropriately to indicate the action taken, as follows:

1. Engineer's Review
    a. Approved
    b. Approved as Noted
    c. Rejected
2. Required Response
    a. Confirm
    b. Revise
    c. Resubmit

C. Unsolicited Submittals: The Engineer will return unsolicited submittals to the sender without action.

END OF SECTION

SECTION 00510
OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.1 SCOPE

A. Provide operation and maintenance data in the form of instructional manuals for use by the Owner's personnel for:

1. All equipment and systems as specified in the respective specifications for that equipment. May include but are not limited to:

a. Pumps

b. Motors

c. Valves (Gate, Air Release, Check, Butterfly, etc.)

d. Flowmeters

e. Electrical Interface Items (SCADA, Telemetry, etc.)

f. Electrical Switches, Relays, Transmitters, Displays, Cabinets

B. Definition: Operation and Maintenance Data

1. The term "operation and maintenance data" includes all product related information and documents which are required for preparation of the plant operation and maintenance manual. It also includes all data which must accompany said manual as directed by current regulations of any participating government agency.

2. Operation and Maintenance Data shall include, but may not be limited to:

a. Name, address and phone number of manufacturers, manufacturer's local service representative, and Subcontractor or installer.

b. Recommended spare parts lists and local sources of supply for parts.

c. Copy of warranty bond and service contract as applicable as well as contact info for warranty claims.

- For every piece of equipment that has its own warranty
- For warranty on workmanship of the entire project as agreed to by the Contractor in contract documents.

d. Complete, detailed written operating instructions for each product or piece of equipment including equipment function; operating characteristics; limiting conditions; operating instructions for startup, normal, and emergency conditions; regulation and control; and shutdown.

e. Complete, detailed written preventive maintenance instructions as defined below.

f. Written explanations of all safety considerations relating to operation and maintenance procedures.

g. Copy of all approved Shop Drawings.

C. Definition: Preventive Maintenance Instructions:

1. The term "preventive maintenance instructions" includes all information and instructions required to keep a product or piece of equipment properly lubricated, adjusted and maintained so that the item functions economically throughout its full design life. This shall include, but are not limited to the following:

a. A written explanation with illustrations for each preventive maintenance task.

b. Recommended schedule for execution of preventive maintenance

c. Trouble shooting instructions.

d. List of required maintenance tools and equipment.

D. Submittals:

1. General: Submit operations and maintenance data to the ENGINEER within 90 days after approval of Shop Drawings.

a. Submit a full Operations and Maintenance Manual at project close to include all pieces as described in this specification combined into one complete document.

2. Number of Copies: 2 physical copy (compiled into one or more binders as specified below) and 2 USB sticks

3. Format Requirements:

a. Use 8½-inch by 11-inch paper of high rag content and quality. Larger drawings or illustrations are acceptable if neatly folded to the specified size in a manner which will permit easy unfolding without removal from the binder. Provide reinforced punched binder tab or provide fly-leaf for each product.

b. All text must be legible typewritten, machine printed originals or high-quality copies of same.

c. Each page shall have a binding margin of approximately 1½ inches and be punched for placement in a three-ring loose leaf or triple post binder. Provide binders. Identify and organize each binder with the following:

- Title "OPERATING AND MAINTENANCE INSTRUCTIONS".
- Title of Project.
- Identity of equipment or structure as applicable.
- Identity of general subject matter covered.
- Expected Organization
- Table of Contents

- Contacts for Contractor and each piece of equipment as well as contact information for warranty claims (if different)
- Operation / Installation / Shop Drawings / Preventive Maintenance Data per piece of equipment

d. Use dividers and indexed tabs between major categories of information such as operating instructions, preventive maintenance instructions, or other. When necessary, place each major category in a separate binder.

e. Provide a table of contents for each binder if more than one is required.

f. Identify products by their functional names in the table of contents and at least once in each chapter or Section. Thereafter, abbreviations and acronyms may be used if their meaning is explained in a table in the back of each binder. Use of model or catalog numbers or letters for identification is not acceptable.

g. Contractor shall furnish required O&M Manuals with complete information and accuracy in order to achieve required approval within two submittals or be subject to back charge fees from the Owner.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Unless shown on the construction plans or called out within the technical specifications as a pay item, operation and maintenance data preparation activities described herein are for informational purposes only. No separate measurement of operation and maintenance data preparation activities will be made by the Contractor for this Work.

4.2 PAYMENT: Unless specified as a pay item, operation and maintenance data preparation activities performed and materials furnished in accordance with this Specification Section will not be paid for directly but are considered to be subsidiary to the pertinent items associated with construction activities. No separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 01000
MOBILIZATION

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall mobilize all materials, labor, equipment, and incidentals in preparation for beginning, with subsequent cleanup, of Work performed under the Contract.

B. Work includes, but is not necessarily limited to: mobilization of personnel, equipment, supplies, and incidentals to the project site; establishment of the Contractor's onsite facilities, safety precautions, scaffolding and/or lifting methods; any other facilities necessary for work on the project; construction submittals; fees for bonds and insurance; obtaining all required permits; coordination with the Owner for the scheduling of all construction activities; disposal and hauling of cleared, grubbed material, debris, surplus excavated material including all existing pipe and appurtenances to be abandoned (where specified in the Drawings), tree protection, coordinating with other utilities for locating buried cables and other utilities during construction, repairing and replacing fences, cleaning and, any other items required for beginning work, but not included explicitly in other bid items.

PART 2 – PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The lump sum price for Mobilization shall not exceed ten percent (10%) of the subtotal of all other base bid items, excluding this item.

4.2 PAYMENT: Partial payments directed towards the "Lump Sum" bid for Mobilization will be structured as follows:

Payment for this item will be payable will be limited to 75% of the contract lump sum price in the first partial payment; and, the balance payable after cleanup and demobilization.

END OF SECTION

SECTION 01005
DEMOLITION

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required for demolitions, removal, and disposal of Work.

B. Included, but not limited to: demolition and removal of existing materials, equipment, or demolition work necessary to install the new Work as shown and specified and to connect same with existing work in an approved manner. Demolition includes structural concrete, foundations, walls, doors, windows, structural steel, metals, roofs, masonry, attachments, appurtenances, piping, electrical and mechanical equipment, paving, curbs, walks, fencing, and similar existing facilities.

C. Demolitions and removals which may be specified under other Sections shall conform to requirements of this Section.

1.2 RELATED SECTIONS

A. Section 01100, Site Preparation

1.3 SUBMITTALS

A. Schedule: Submit for approval proposed methods, equipment, and operating sequences. Include coordination for shut-off, capping, temporary services, continuation of utility services, and other applicable items to ensure no interruption of Owner’s operations.

1.4 JOB CONDITIONS

A. Protection:

1. Perform all demolition and removal Work to prevent damage or injury to structures, occupants thereof and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.

2. Closing or obstructing of roadways, sidewalks, and passageways adjacent to the Work by the placement or storage of materials will not be permitted, and all operations shall be conducted with a minimum interference to traffic on these ways.

3. Erect and maintain barriers, lights, sidewalk sheds, and other necessary protective devices.

4. Repair damage to facilities to remain, or to any property belonging to the Owner or occupants of the facilities.

5. Protect all reference points, benchmarks and monuments from dislocation or damage. Replace or repair immediately any points damaged, destroyed, or dislocated. Protect and maintain all conduits, drains, inlets, sewers, pipes, and wires that are to remain on the property.

B. Scheduling:

1. Carry out operations to avoid interference with Owner's operations and work in the existing facilities.

C. Existing Conditions

1. Do not work or store materials or equipment on public or adjacent property.

2. Do not allow material and debris to accumulate on the site.

D. Damage:

1. Contractor shall be responsible for repair of any damage to streets, curbs or other property not specifically called for as an item to be demolished.

E. Notification:

1. At least 48 hours prior to commencement of a demolition or removal, notify Engineer in writing of proposed schedule therefor. Owner will inspect the existing equipment and mark for identification those items which are to remain the property of the Owner. Do not start removals without the permission of the Engineer and Owner.

F. Explosives:

1. No explosives will be used for demolition.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 GENERAL

A. All materials and equipment removed from existing work shall become the property of Contractor, except for those which Owner has identified and marked for his use, in accordance with the Summary of Work. All materials and equipment marked by the Owner to remain his shall be carefully removed by the Contractor, so as not to be damaged, and shall be cleaned and stored on or adjacent to the site in a protected place specified by the Engineer or loaded onto trucks provided by the Owner.

B. Contractor shall dispose of all demolition materials, equipment, debris, and all other items not marked by the Owner to remain as his, off the site and in conformance with all existing applicable laws and regulations.

C. Surfaces of walls, floors, ceilings, or other areas which are exposed by any of the removals specified herein, and which will remain as architecturally finished surfaces shall be repaired and re-finished by the Contractor with the same or matching materials as the existing adjacent surface or as may be otherwise approved by the Engineer.

D. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

2. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the Work.

E. Building Demolition:

1. Unless otherwise approved by Engineer, proceed with demolition from the top of the structure to the ground. Complete demolition work above each floor or tier before disturbing supporting members of lower levels.

2. Demolish concrete and masonry in small sections.

3. Remove structural framing members and lower to ground by means of hoists, derricks, or other suitable methods.

4. Break up and remove foundations and slabs-on-grade, unless otherwise shown to remain.

5. Locate equipment used for demolition work, and remove demolished materials, to not impose excessive loads on supporting walls, floors or framing to remain after demolition.

3.2 STRUCTURAL REMOVAL

A. Remove structures to the lines and grades shown unless otherwise directed by the Engineer. Where no limits are shown, the limits shall be 4 inches outside the item to be installed. The removal of masonry beyond these limits shall be at the Contractor’s expense and these excess removals shall be reconstructed to the satisfaction of the Engineer with no additional compensation to the Contractor.

B. All concrete, brick, tile, concrete block, roofing materials, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure shall be removed and taken from the site, unless otherwise approved by the Engineer. Demolished items shall not be used in backfill adjacent to structures or in pipeline trenches.

C. After removal of parts or all of masonry walls, slabs and like work which tie into new Work or existing work, the point of junction shall be neatly repaired to leave only finished edges and surface exposed.

D. The jambs, sills and heads of any new windows, passageways, doors, or

other openings cut into new Work or existing work, shall be dressed with new masonry, concrete or metal to provide a smooth, finished appearance.

E. Where new anchoring materials including bolts, nuts, hangers, welds and reinforcing steel, are required to attach new Work to the existing work they shall be included under this Section, except where specified elsewhere.

F. Demolished reinforced concrete shall be disposed in an approved and licensed location by the Contractor. Contractor shall provide demolition, transport, and landfill disposal fees as part of the Work. Alternately, the Contractor may pulverize concrete to remove reinforcing steel and dispose of concrete debris and reinforcing steel in an approved off-site location.

3.3 MECHANICAL REMOVALS

A. Mechanical removals shall consist of dismantling and removing of existing piping, pumps, motors, equipment, and other appurtenances as specified, shown, or required for the completion of the Work. It shall include cutting, capping, and plugging as required, except that the cutting of existing piping for the purpose of making connections thereto.

B. Existing process, water, chemical, gas, fuel oil and other piping not required for the new Work shall be removed where shown or where it will interfere with new Work. Piping not indicated to be removed or which does not interfere with new Work shall be removed to the nearest solid support, capped, and left in place. Chemical fuel lines and tanks shall be purged and made safe prior to removal or capping. Where piping that is to be removed passes through existing walls, it shall be cut off and properly capped on each side of the wall.

C. When underground piping is to be altered or removed, the remaining piping shall be properly capped. Abandoned underground piping may be left in place unless it interferes with new Work or is shown or specified to be removed. Removed pipe trenches shall be restored to grade with ordinary compaction methods.

D. Waste and vent piping shall be removed to points shown. Pipe shall be plugged with cleanouts and plugs. Where vent stacks pass through an existing roof that is to remain, they shall be removed and the hole in the roof properly patched and made watertight.

E. Any changes to potable water piping and other plumbing and heating system work shall be made in conformance with all applicable codes and under the same requirements as other underground piping. All portions of the potable water system that have been altered or opened shall be pressure tested and disinfected in accordance with Section 01350 of these Specifications and local codes. Other plumbing piping and heating piping shall be pressure tested only.

3.4 ELECTRICAL REMOVALS

A. Electrical removals shall consist of the removal of existing transformers, distribution switchboards, control panels, motors, conduits and wires, poles and overhead wiring, panelboards, lighting fixtures, and miscellaneous

electrical equipment all as shown, specified, or required to perform the Work.

B. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to keep the integrity of the grounding systems.

C. Distribution switchboards shall be removed or modified as shown. Switchboards to be removed shall be disconnected and dismantled, and all components shall be disposed of off the site. Circuit breakers and other control equipment on modified switchboards that will no longer be used shall be removed unless otherwise shown or specified. All new openings cut into the modified switchboard panels shall be cut square and dressed smooth to the dimensions required for the installation of the new equipment.

D. Motors shall be disconnected and removed where shown or specified. Motors not designated by the Owner to be salvaged shall be removed from the site. Motors or other electrical gear designated for reuse shall be stored in enclosed, heated storage.

E. Conduits and wires shall be abandoned or removed where shown. All wires in abandoned conduits shall be removed, salvaged, and stored. Abandoned conduits concealed in floor or ceiling slabs, or in walls, shall be cut flush with the slab or wall at the point of entrance. The conduits shall be suitably plugged, and the area repaired in a flush, smooth, approved manner. Exposed conduits and their supports shall be disassembled and removed from the site. Repair all areas of work to prevent rust spots on exposed surfaces.

F. Were shown or otherwise required, wiring in underground duct banks shall be removed. All such wiring shall be salvaged and stored as specified. Contractor shall verify the function of all wiring before disconnecting and removing it. Ducts which are not to be reused shall be plugged where they enter buildings and made watertight.

G. Where shown, direct-burial cable shall be removed.

H. Poles and overhead wiring shall be removed as shown and specified. Existing substation and poles owned by the power company will be removed by the power company. Poles not owned by the power company shall be completely removed from the site by the Contractor. Contractor shall perform this work after the new service has been completed and energized, and in accordance with the approved schedule. Contractor also shall make all the necessary arrangements with the power company for the removal of their transformers and metering equipment after the new electrical system has been installed and energized.

I. Panelboards where shown shall be removed and disposed of off the site. Where shown or specified, they shall be replaced with new panelboards at the same or adjacent locations. All cutting and patching necessary for the removal and replacement of panelboards shall be performed.

J. Lighting fixtures shall be removed or relocated as shown. Fixtures not relocated shall be removed from the site. Relocated fixtures shall be

carefully removed from their present location and rehung where shown.

K. Wall switches, receptacles, starters, and other miscellaneous electrical equipment shall be removed and disposed of off the site as required. Care shall be taken in removing all equipment to minimize damage to architectural and structural members. Any damage incurred shall be repaired.

3.5 ALTERATIONS AND CLOSURES

A. Alterations shall conform with all applicable Specifications, the Drawings, and the directions and approvals of the Engineer.

B. Where alterations require cutting or drilling into existing floors, walls, and roofs, the holes shall be repaired in an approved manner. The Contractor shall repair such openings with the same or matching materials as the existing floor, wall, or roof or as otherwise approved by the Engineer. All repairs shall be smoothly finished unless otherwise approved by the Engineer.

C. Openings in existing concrete slabs, ceilings, masonry walls, floors and partitions shall be closed and sealed as shown or otherwise directed by the Engineer and Owner. New Work shall be keyed into the existing Work in an acceptable manner.

D. New reinforcing steel shall be welded to the existing reinforcing. Welding shall conform to AWS D12.1, Reinforcing Steel Welding Code. In general, use the same or matching materials as the existing adjacent surface. The finished closure shall be a smooth, tight, sealed, permanent closure acceptable to the Engineer.

3.6 CLEANUP

A. Contractor shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the Work, all materials, equipment, waste, and debris of every sort shall be removed, and premises shall be left, clean, neat, and orderly, and graded to plan.

B. Demolished reinforced concrete shall be disposed at an approved and licensed disposal site at Contractor’s expense. Alternately, the Contractor may pulverize concrete to remove reinforcing steel and dispose of concrete debris and reinforcing steel at an approved off-site location.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Unless shown on the Drawings or called out within the Specifications as a pay item, demolition activities described herein are for informational purposes only. No separate measurement of demolition activities will be made by the Contractor for this Work.

4.2 PAYMENT: Unless specified as a pay item, demolition activities performed, and materials furnished in accordance with this Section will not be paid for directly but are subsidiary to the pertinent items associated with construction activities. No separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 01100
SITE PREPARATION

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section shall consist of preparing the designated easements and/or right-of-way as necessary for construction operations.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 CLEARING

A. The surface of the ground, for the area to be cleared and grubbed, shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish, topsoil and vegetation removal, and all other objectionable obstructions resting on, or protruding through, the surface of the ground.

B. Trees and shrubs designated for preservation shall be carefully trimmed as directed and shall be protected from scarring, barking, or other injuries during construction. Exposed ends of pruned limbs shall be treated with an approved pruning material. Tree protection shall be installed as necessary per the Drawings.

C. Clearing operations shall be conducted so that the Contractor shall not damage the existing structures and installations, or those structures under construction. Clearing shall be conducted in a manner that provides for the safety of employees and others.

D. Clearing away structures shall consist of removing remains of houses or other structures not completely removed previously (by the Contractor or others), foundations, floor slabs, concrete, brick, lumber, plaster, cisterns, septic tanks, basements, abandoned utility pipes or conduits, equipment or other foundations, fences, retaining walls, outhouses, shacks and all other debris, as well as buried concrete slabs, curbs, gutters, driveways and sidewalks.

3.2 GRUBBING

A. Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade.

B. All depressions excavated below the original ground surface for, or by the removal of, such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

PART 4 – JOB CONDITIONS

4.1 STRIPPING

A. In areas so designated, topsoil shall be stockpiled. Stockpiled topsoil shall be protected until it is placed as specified.

B. Any topsoil remaining after all Work is in place shall be removed and disposed of by the Contractor in accordance with local, state and federal regulations.

4.2 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

A. Dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris away to an approved facility.

B. Disposal by burning or burial will not be permitted.

C. The cost of disposal (including hauling) of cleared, grubbed material, debris, surplus material shall be considered a subsidiary obligation of the Contractor.

4.3 FENCES

A. Unless shown otherwise in the Contract Documents, all fences along the proposed route and Right-Of-Way which are damaged or removed temporarily by the Contractor shall be replaced by the Contractor to an equal or better condition.

4.4 HOLES

A. Holes remaining after removal of structures, objectionable materials, etc., shall be backfilled and the entire area shall be bladed to prevent ponding of water and to provide adequate drainage of storm water.

4.5 HAZARDOUS MATERIAL

A. If the Contractor encounters hazardous substances, industrial waste, or other environmental pollutants, underground storage tanks, or conditions conductive to environmental damage, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner in writing.

B. The Contractor shall not be responsible for, or be required to conduct, any investigation, site monitoring, containment, cleanup, removal, restoration or other remedial work of any kind or nature under any applicable state or federal law, regulation, ordinance, or any judicial order.

PART 5 – MEASUREMENT AND PAYMENT

5.1 No direct measurement or payment will be made for the work to be done or the equipment to be furnished under this item but shall be considered subsidiary to the particular items of work for which unit prices are required in the proposal.

END OF SECTION

SECTION 01140
DEWATERING

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all equipment, fuel, materials, and labor necessary for dewatering, along with the necessary control and disposal of groundwater, on a continual basis during construction.

1.2 DESCRIPTION OF REQUIREMENTS

A. Dewatering shall include the lowering of the groundwater table to relieve any hydrostatic head that could cause a decrease in the stability of the excavated subgrade. Remove and dispose of water and provide siltation settling basins for all discharges from dewatering systems.

B. Dewatering also shall include the intercepting of seepage which could otherwise emerge from the slope or sides of excavations which could cause a decrease in the stability of the excavated subgrade or the slopes or sides of the excavations.

C. The Contractor shall assume full responsibility and expense for the adequacy of the dewatering system with no additional contract time or cost allowance for performance.

1.3 REFERENCE STANDARDS

A. The drilling, operation, and abandonment of all dewatering wells used in the dewatering system shall comply with regulations of the Texas Commission on Environmental Quality (TCEQ), and the Texas Water Well Drillers Association.

1.4 SUBMITTALS

A. Submit construction plans of dewatering well point system, settling basins and discharge facilities for review by the Owner/Engineer prior to dewatering system installation.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Selection of equipment and materials is at the option of Contractor as necessary to achieve desired results for dewatering.

B. Eductors, well points, or deep wells, where used, shall be furnished, installed and operated by an experienced Subcontractor who is engaged regularly in ground water control system design, installation and operation.

C. All equipment must be in good repair and operating order.

D. Sufficient standby equipment and materials shall be kept available to ensure continuous operation, where required.

PART 3 - EXECUTION

3.1 DEWATERING

A. The dewatering system shall be capable of providing an excavated subgrade that is relieved of any hydrostatic pressure that could cause a decrease in the stability of the excavated subgrade, and which will provide the necessary groundwater control for the proper performance required to complete the Work described within the Project Specifications.

B. As part of his request for review of a dewatering system, the Contractor shall demonstrate the adequacy of the proposed system and well point filter sand by means of a test installation at the jobsite. Discharge water shall be clear, with no visible soil particles contained within a one-quart sample.

C. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

D. The Contractor shall provide for the disposal of the water removed from the excavation in such a manner as to not cause injury to the public health, private or public property, or to any portion of the work completed or in progress, to the surface of the streets, or cause any impediment to the reasonable use of the site by other contractors.

E. The dewatering system shall not cause damage to newly constructed or existing buildings, utilities, and other work due to the loss of support from incompletely drained soils or from removal of soil particles resulting from the dewatering system operation.

F. If the dewatering system utilized by the Contractor causes or threatens to cause damage to new or existing facilities, the dewatering system shall be modified to prohibit such damage at no additional cost to the Owner.

G. Dispose of subsurface water collected in the manner which conforms to all applicable local and state ordinances, statutes and laws.

H. Maintain continual and complete effectiveness of the dewatering system operation to provide a firm, stable, and excavated subgrade at all times as required for proper performance of Work.

I. Provide dewatering necessary to maintain the groundwater table below the level of backfill as it is being placed.

J. Provide dewatering necessary to maintain the groundwater table below the level of backfill as requested by the Owner. The Contractor’s proposed method of dewatering shall include a minimum of two operating groundwater observation wells or piezometers at each proposed structure and one observation well at each manhole to be used to determine the water level during construction of the structures. Locations of the observation wells shall be at structures and along pipelines as approved by the Owner prior to their installation. The observation wells shall be extended to 6 inches above finished grade, topped with screw-on caps, protected by a 4-inch thick, 24-inch x 24-inch square concrete base, and left in place at the completion of the project.

K. The Contractor shall maintain log readings of the dewatering system documented at least daily. The Contractor shall submit these readings to the Inspector for

review, if requested.

PART 4 – JOB CONDITONS

4.1 EROSION CONTROL

A. Provide adequate protection from erosion that may be caused by any of the dewatering operations utilized during the course of the construction. Any damage, disruption or interference to newly constructed work or existing properties, buildings, structures, utilities and/or other work resulting directly or indirectly from dewatering operations conducted under this Contract shall be remedied by the Contractor, at no additional cost to the Owner.

4.2 TREATMENT OF DEWATERING OPERATIONS DISCHARGES

A. Provide such additional treatment devices as may be required to meet the provisions of the Contract. This may include the construction of sumps and/or settling basins, stone rip-rap, silt fences or other requirements. The treatment devices shall be removed afterwards and/or filled in with acceptable backfill material and restored to original conditions once they are no longer needed, at no additional cost to the Owner.

4.3 NOISE CONTROL

A. When dewatering operations continue between the hours of 6 PM and 8 AM, the Contractor shall control the noise to meet local standards.

PART 5 – MEASUREMENT AND PAYMENT

5.1 MEASUREMENT: Dewatering operations are considered to be subsidiary to Section 01230 – Excavation and Backfill, and no separate measurement will be made by the Contractor for this Work.

5.2 PAYMENT: Dewatering operations are considered to be subsidiary to Section 01230- Excavation and Backfill, and no separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 01220

EXPLORATORY EXCAVATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section covers exploratory excavation, backfilling exploratory excavation, and restoration of the ground surface as necessary to locate existing underground structures. This includes excavation within the limits of construction or as required.

1.2 DESCRIPTION

A. Exploratory excavation shall be performed for the purpose of determining the location of underground structures and utilities using tight control machinery supplemented by hand labor.

B. Damage to existing structures and utilities shall be avoided during exploratory excavation. Any such structures or utility damaged by the Contractor shall be replaced or repaired at no cost to the Owner.

1.3 CONTROL OF WORK

A. The locations at which exploratory excavations are to be made shall be determined by the Contractor for facilitating safe and thorough execution of the work. In addition, exploratory excavations may be indicated in the Contract Documents or designated by the Owner.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 SCHEDULING

A. Consult with the Owner as to the location of the exploratory excavations so that this work may be scheduled sufficiently in advance of installation of other items of the Work.

B. Obtain all available information on the location of existing underground structures and utilities prior to starting this type of excavation.

C. Notify the Utility Owner of the structures and/or utilities to be affected, in sufficient time to allow their Representatives to observe the exploratory excavations.

3.2 EXCAVATION

A. Conduct all excavations with extreme care so as not to damage any existing structure or utility. If damage occurs notify the Owner and the respective Utility Owner immediately. Make repairs promptly if authorized by the Utility Owner or coordinate with the Utility Owner to facilitate prompt repair and compensation for damages.

B. When the location of underground structures or utilities has been determined, notify the Owner.

3.3 BACKFILL AND RESTORATION

A. Exploratory excavations shall be backfilled and the surface restored according to the applicable Section of the Contract Documents unless otherwise directed by the Owner.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Exploratory excavation operations are considered to be subsidiary to 01230 – Excavation and Backfill, and no separate measurement will be made by the Contractor for this work.

4.2 PAYMENT: Exploratory excavation operations are considered to be subsidiary to Section 01230 – Excavation and Backfill, and no separate payment will be made to the Contractor for this work.

END OF SECTION

SECTION 01230
EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section shall consist of furnishing all labor, materials, equipment, and incidentals necessary to perform all excavation (unclassified), backfill, fill, grading and slope protection required for completing the structural and/or utility piping work and/or other work shown within the Drawings and specified herein.

B. The item shall include, but not necessarily be limited to: manholes, vaults, duct conduit, pipe, and roadways and paving; all backfilling, fill and required borrow; grading; dewatering, sheeting, shoring, bracing, water handling, and all other work incidental and specified herein.

C. Trench excavation shall be in accordance with the Typical Trench Backfill Standard Detail as shown within the Drawings.

D. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 QUALITY ASSURANCE

A. Required Tests:

1. The Owner will engage the services of a qualified testing laboratory to make tests and determine acceptability of the fill or materials as listed below.

2. Required tests:

a. Select Fill Samples: Gradation, ASTM D422.

b. Compacted Select Fill: Compaction, ASTM D1556, ASTM D1557, and ASTM D2922.

B. Permits and Regulations:

1. Obtain all necessary permits for work in roads, rights-of-ways, railroads, etc.

2. Obtain permits as required by local, state and federal agencies for discharging water from excavations.

3. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

1.3 RELATED SECTIONS

A. Section 01140, Dewatering

B. Section 01240, Trench Excavation Safety

C. Section 01410, Testing Laboratory Services

D. Section 02650, PVC Pipe for Water Main

E. Section 02660, Ductile Iron Pipe

F. Section 02680, Ductile Iron Fittings

G. Section 03100, Sanitary Sewer Mains

H. Section 03200, Sanitary Sewer Manholes

1.4 REFERENCE STANDARDS

A. Comply with the applicable provisions and recommendations of the following except as otherwise shown or specified; latest revision thereof shall apply.

1. ASTM A36 - Specification for Structural Steel.

2. ASTM A328 - Specification for Steel Sheet Piling.

3. ASTM D422 - Method for Particle-Size Analysis of Soils.

4. ASTM D1556 - Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

5. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft 16/cu ft) (2,700 KN-m/cu m).

6. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

7. AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

8. Occupational Safety and Health Administration (OSHA) Standards, Title 29, Code of Federal Regulations, Part 1926, Section .650 (Subpart P-Excavations).

1.5 SUBMITTALS

A. Drawings shall be prepared by a licensed Texas Professional Engineer recognized as an expert in the specialty excavation and backfill activities involved. Drawings shall be submitted to the Engineer for review and record purposes only. Calculations shall not be submitted for review, unless requested by the Engineer. Drawing submittals will not be checked and will not imply approval by Engineer of the work involved. The Contractor shall be solely responsible for designing, installing, operating and maintaining whatever system is necessary to satisfactorily accomplish all necessary sheeting, shoring, bracing, protection, cofferdams, underpinning and dewatering.

B. Test Reports - Borrow, Backfill, and Grading:

1. Owner’s testing laboratory will submit copies of the following reports directly to Engineer, with a copy to the Contractor:

a. Tests on borrow material.

b. Tests on footing subgrade.

c. Field density tests.

d. Optimum moisture - maximum density curve for each soil type used for backfill.

e. Tests of actual unconfined compressive strength or bearing tests of each strata.

C. The Contractor shall submit samples of all select fill, gravel and base materials as required.

1. Deliver samples to Owner.

D. Compaction equipment and proposed methods.

E. Erosion and sedimentation control plan.

1.6 TRENCH EXCAVATION SAFETY

A. Trench Excavation Safety shall conform to requirements contained within Section 01240 of these Specifications.

1.7 SITE PREPARATION

A. Site preparation shall be completed in accordance with Section 01100 of these Specifications.

1.8 DEWATERING

A. Dewatering shall be conducted in accordance with Section 01140 of these Specifications.

1.9 JOB CONDITIONS AND SAFETY

A. The Contractor shall examine the site and review the available test borings or undertake his own soil borings prior to submitting his bid, taking into consideration all conditions that may affect the work.

B. The Owner will not assume responsibility for variations of sub-soil quality or conditions at locations other than places shown at the time the subsurface investigation was made. Boring log data and soil samples may be available for examination by the Contractor upon request.

C. Existing Structures: The Drawings may show certain surface and underground structures adjacent to the Work. This information has been obtained from existing records. It is not guaranteed to be correct or complete and is shown for the convenience of the Contractor. Contractor shall explore ahead of the required excavation to determine the exact location of all structures. They shall be supported and protected from damage by Contractor. If they are broken or damaged during construction, they shall be restored immediately by Contractor at the Contractor’s expense.

D. Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Owner of such piping or utility immediately for directions on how to proceed with construction activities.

2. Cooperate with the Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of the Owner.

3. Demolish and completely remove from site all existing underground utilities indicated within the Contract Documents to be removed.

E. Protection of Persons and Property: Barricade open excavations occurring as part of this Work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.

1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

F. Use of Explosives:

1. The use of explosives at the job site will not be permitted.

G. Dust Control:

1. Conduct all operations and maintain areas of activity, including sweeping and sprinkling of roadways adjacent to the work area, to minimize creation and dispersion of dust. Calcium chloride may be used to control serious or prolonged dust problems, subject to approval of Engineer.

1.10 CODES, ORDINANCES, AND STATUTES

A. The Contractor shall be familiarized and comply with all applicable codes, ordinances, statutes, and bear sole responsibility for any penalties imposed for noncompliance.

1.11 SHORING, SHEETING, BRACING, AND SLOPING

A. The Contractor shall provide shoring, sheeting, bracing, or sloping as required to protect excavations. All shoring, sheeting, bracing, and sloping will be installed and maintained in accordance with OSHA standards and other applicable laws.

B. For trench sheeting for pipes, no sheeting is to be withdrawn if driven below mid-diameter of any pipe, and no wood sheeting shall be cut off at a level lower than one (1) foot above the top of any pipe unless otherwise instructed by the Owner. If during the progress of the Work the Owner decides that additional wood sheeting should be left in place, he may instruct the Contractor in writing. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given for an alternate method of removal.

C. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. Unless otherwise approved or indicated in the Drawings, all sheeting and bracing shall be removed after completion of the substructure, care being taken not to disturb or otherwise injure the finished masonry. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools

especially adapted to that purpose, by watering or otherwise as may be required.

D. Owner has the right to instruct the Contractor with regard to sheeting and bracing to be left in place shall not be construed as creating any obligation on his part to issue such instructions, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or on the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

E. The Contractor shall construct cofferdams and sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing, and cofferdams shall be adequate to withstand all pressures to which the structure will be subjected. Pumping, bracing, and other work within the cofferdam shall be done in a manner to avoid disturbing any construction of the masonry enclosed. Any movement or bulging which may occur shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.

1.12 EROSION AND POLLUTION CONTROLS

A. The Contractor shall provide silt barriers, hay bales or other approved devices to prevent erosion or siltation of waterways and drainage courses, in accordance with the Drawing details.

PART 2 – PRODUCTS

2.1 SOIL MATERIALS

A. General:

1. Materials for use as base, fill and backfill shall be as described below.

a. Satisfactory soil materials are defined as those complying with American Association of State Highway and Transportation Officials (AASHTO) M-145, soil classification Groups A-1, A-2-4, A-2-5 and A-3.

b. Unsatisfactory soil materials are those defined in AASHTO M-145 soil classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 along with peat and other highly organic soils.

B. Structural Fill:

1. Structural fill material shall be well graded soil material consisting of coarse aggregate to medium to fine grain sized sand, free of organic, deleterious and/or compressible material. Rock in excess of 3-1/2 inches in diameter shall not be used in the fill material. Structural fill shall not contain hardpan, stones, rocks, cobbles or other similar materials.

C. Select Common Fill:

1. Select common fill material shall be satisfactory soil material containing no more than 15 percent by weight finer than No. 200 mesh sieve. It shall be free from organic matter, muck, marl, and rock exceeding 3-1/2 inches in diameter.

Select common fill shall not contain broken concrete, masonry, rubble or other similar materials.

2. Material falling within the above referenced specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Owner, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials.

D. Backfill:

1. Sanitary Sewer Backfill

a. Bedding Material

i. The bedding material shall extend up the sides of the main sufficient to embed the lower quadrant of the main.

ii. The bedding material shall be composed of well-graded, crushed stone, or gravel conforming to the requirements of Table 1 unless modified by the Engineer in writing.

Table 1	
Sanitary Sewer Backfill Materials	
Sieve Size	**Tolerance (%)**
1-1/2"	0
1"	0-5
½"	40-75
#4	90-100
#8	95-100

2. Water Main Backfill

a. Bedding Material

i. The bedding and initial backfill materials for ductile iron pipe (DI), Polyvinyl Chloride Pipe (PVC), High Density Polyethylene Pipe (HDPE) Pipe, and Wrapped Steel (WS) Pipe in all nominal diameters shall be composed of well graded crushed stone or gravel conforming to the requirements of Table 2 unless notified by the Engineer in writing.

Table 2		
Potable Water Backfill Materials		
Sieve Size	**Avg. Retained (%)**	**Tolerance (%)**
1/2"	0	0
3/8"	0	0-5
#4	30	20-45
#8	90	90-100
#16	95	95-100
#30	98	98-100

E. Secondary and General Backfill:

1. Provide approved soil materials for backfill and fill, free of clay, rock, or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetable and other organic matter and other deleterious materials. Previously excavated materials meeting these requirements may be used for backfill.

F. Backfill under Existing or Future Pavement Structures

1. No heavy equipment will be used for soil backfilling operations until sufficient cover has been placed and compacted over all pipes and other existing utilities that may be damaged by such equipment. Testing of the completed backfill in streets and under and around structures shall meet the specified density requirements. Initial testing shall not be at Contractor's expense and shall conform to the General Conditions.

2. When soil backfill is to be placed under existing or future pavement structures and within 2 feet of any structures, the backfill shall be compacted to the required density using any method, type and size of equipment, which will give the required compaction without damaging adjacent pipe or bedding. The depth of layers, prior to compaction, shall depend upon the type of sprinkling and compacting equipment used and the test results thereby obtained. Prior to and in conjunction with the compaction operation, each layer shall be brought to the moisture content necessary to obtain the required density and shall be kept level to insure uniform compaction over the entire layer. Testing for density shall be in accordance with Test Method Tex-114-E and Test Method Tex-115-E.

3. Each layer of soil backfill must provide the density as required herein. Swelling soils (soils with plasticity index of 20 or more) shall be sprinkled as required to provide not less than optimum moisture nor more than 2 percent over optimum moisture content and compacted to the extent necessary to provide not less than 95 percent nor more than 102 percent of the density as determined in accordance with Test Method Tex-114-E. Non-swelling soils (soils with plasticity index less than 20) shall be sprinkled as required and compacted to the extent necessary to provide not less than 95 percent of the density as determined in accordance with Test Method Tex-114-E.

4. After each layer of soil backfill is complete, tests may be made by the Owner’s designated representative. If the material fails to meet the density indicated, the course shall be reworked as necessary to obtain the indicated compaction and the compaction method shall be altered on subsequent Work to obtain indicated density.

5. At any time, the Owner’s designated representative may order proof rolling to test the uniformity of compaction of the backfill layers. All irregularities, depressions, weak or soft spots that develop shall be corrected immediately by the Contractor.

6. Should the soil backfill, due to any reason, lose the required stability, density or finish before the pavement structure is placed, it shall be recompacted and refinished at the sole expense of the Contractor. Excessive loss of moisture in the subgrade shall be prevented by sprinkling, sealing or covering with a subsequent backfill layer or granular material. Excessive loss of moisture shall be construed to exist when the subgrade soil moisture content is more than 4

percent below the optimum of compaction ratio density. Backfill shall be placed from the top of the bedding material to the existing grade, base course, subgrade or as otherwise indicated. The remainder of the street backfill shall be Flexible Base, Concrete or Hot Mix Asphalt Concrete as indicated or to be replaced in kind to the surface removed to perform the Work.

G. Topsoil

1. Topsoil shall be reasonably free from subsoil, stumps, roots, brush, stones (2 inches or more in diameter), clay lumps, or similar objects.

2. The topsoil and or soil mixture, unless otherwise specified or approved, shall have a PH range of approximately 5.5 to 8.0.

3. The organic compound of topsoil shall be not less than 1%.

2.2 WATER

A. Water used in compaction shall be clean and free from oil and grease. It shall not contain any organic matter or any other deleterious substances.

2.3 COMPACTION EQUIPMENT

A. Compaction equipment shall be of suitable type and adequate to obtain the densities specified and shall provide satisfactory breakdown of materials to form a dense fill. Compaction equipment shall be operated in accordance with the Manufacturer's instructions and recommendations.

B. Equipment shall be maintained in such condition that it will deliver the manufacturer's rated compaction effort. If inadequate densities are obtained, larger and/or different types of additional equipment shall be provided by the Contractor. Hand-operated equipment shall be capable of achieving the specified densities.

2.4 MOISTURE CONTROL EQUIPMENT

A. Equipment for applying water shall be of a type and quality adequate for the work, shall not leak, and shall be equipped with a distributor bar or other approved device to assure uniform application. Equipment for mixing and drying out material shall consist of blades, discs, or other approved equipment.

PART 3 – EXECUTION

3.1 GENERAL

A. Material shall be furnished, as required, from off site sources and hauled to the site.

B. The Contractor shall take all the necessary precautions to maintain the work area in a safe and workable condition.

C. The Contractor shall protect his work at all times by flagging, marking, lighting and barricading. It shall also be the Contractor’s responsibility to preserve and protect all above and underground structures, pipelines, conduits, cables, drains or utilities which are existing at the time he encounters them. Failure of the Contract Documents to show the existence of these obstructions shall not relieve the

Contractor from this responsibility. The cost of repair of any damage which occurs to these obstructions during or as a result of construction shall be borne by the Contractor without additional cost to the Owner.

3.2 INSPECTION

A. Provide the Resident Inspector with sufficient notice and with the means to examine the areas and conditions under which excavating, filling, and grading are to be performed. The Resident Inspector will notify the Owner and the Engineer if conditions are found that may be detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

3.3 EXCAVATION

A. Excavation of all trenches required for the installation of pipes and electrical ducts shall be made to the depths indicated in the Contract Documents. Excavate in such manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches, for bracing and supporting, and for pumping and drainage facilities. The trench width at the top of the pipe shall not exceed the allowable value as determined by the depth of cut and indicated in the Contract Documents.

B. Rock shall be removed to a minimum 4-6 inches clearance around the bottom and sides of all the pipe or ducts being laid as shown in the Contract Documents.

C. The bottom of the excavations shall be firm, dry and acceptable to the Owner. Excavate unsatisfactory soil material from the bottom of the trench to a depth determined by the Owner/Engineer and replace with rock or shell bedding.

D. Where pipe or ducts are to be laid in bedding or encased in concrete, the trench may be excavated by machinery to, or just below, the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

E. Where the pipes or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to the trench bottom by machinery. The last of the material being excavated shall be done manually in such a manner that will give a flat bottom true to grade so that pipe or duct can be evenly and uniformly supported along its entire length on un- disturbed material or bedding rock. Bell holes shall be made as required manually so that there is no bearing surface on the bells and pipes are supported along the barrel only.

F. The Contractor shall abide by the following schedule of criteria concerning interferences with other utilities. In no case shall there be less than 0.33 feet (4 inches) between any two pipelines or between pipelines and structures.

G. Concrete encasement shall be provided in accordance with the Concrete Encasement standard detail drawing shown within the Drawings.

3.4 BACKFILLING

A. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid,

jointed, and inspected and the trench filled with suitable bedding material.

B. Backfilling over ducts shall begin not less than three days after placing concrete encasement.

C. All backfilling shall be prosecuted expeditiously and as detailed in the Contract Documents.

D. Select granular bedding material shall meet the required measurements.

E. The remainder of the trench shall be filled with compacted backfill, free from stones having a diameter greater than 2 inches and thoroughly compacted with a tamper as fast as placed.

F. The filling shall be carried up evenly on both sides with at least one person tamping for each person shoveling material into the trench.

G. The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted with topsoil with mechanical equipment. The topsoil shall be mound over the original ground surface to permit passage of vehicles to allow for future settling. There shall be 4 inches of topsoil on the trench supplied from the stockpiled topsoil.

H. In locations where pipes pass through building walls, the Contractor shall take the following precautions to consolidate the refill up to an elevation of at least 1 foot above the bottom of the pipes:

1. Place structural fill in such areas for a distance of not less than 3 feet either side of the center line of the pipe in level layers not exceeding 6 inches in depth.

2. Wet each layer to the extent requested and thoroughly compact each layer with a power tamper.

3.5 GRADING

A. Grading shall be performed at such places as are indicated in the Contract Documents, to the lines, grades, and elevations shown or as approved by the Owner/Engineer and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as requested. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. Temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

B. If at the time of excavation, it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled in approved areas for later use. No extra payments will be considered for the stockpiling or double handling of excavated material.

C. The right is reserved by the Owner to make minute adjustments or revisions in lines or grades if found necessary as the work progresses, due to discrepancies in the Contract Documents or in order to obtain a satisfactory construction outcome.

D. Stones or rock fragments larger than 1-1/2 inches in their greatest dimensions will not be permitted within the top 12 inches of the subgrade line of all dikes, fills or

embankments.

E. All fill slopes shall be uniformly dressed to the grade, cross-section and alignment shown in the Contract Documents, or as approved in writing by the Owner.

F. In cuts, all loose or protruding rocks on the back slopes shall be jarred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the grade, cross-section and alignment shown in the Contract Documents or as approved in writing by the Owner.

G. No grading is to be done in areas where there are existing pipelines that may be uncovered or damaged until such lines which must be maintained are relocated, or where lines are to be abandoned, all required valves are closed and drains plugged at manholes.

I. The Contractor shall replace all pavement that is cut or otherwise damaged during the progress of the work as specified elsewhere herein.

3.6 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Owner's testing service may inspect and approve subgrades and fill layers before construction work is performed thereon. Tests of subgrades and fill layers may be taken as follows:

1. Footing Subgrade: For each strata of soil on which footings will be placed, at least one test will be made to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Engineer.

2. Tank and Building Slab Subgrade: At least one field density test of subgrade will be made for every 2,000 square feet of tank subgrade or building slab, but in no case less than 3 tests will be made per tank or building structure. In each compacted fill layer, one field density test will be made for every 2,000 square feet of overlaying building slab or tank subgrade, but in no case less than 3 tests will be made.

B. If testing service reports or field inspections show subgrade or fills are below specified density, the Contractor shall provide additional compaction at no additional expense to the Owner.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Unless shown on the Drawings or within these Specifications as a pay item, the structural and/or utility excavation and backfill quantities shown or described are for informational purposes only. No separate measurement of excavation and backfill quantities will be made by the Contractor for this Work.

4.2 PAYMENT: Unless specified as a pay item, structural and/or utility excavation and backfill performed and materials furnished in accordance with this Specification Section will not be paid for directly but is considered to be subsidiary to the pertinent items associated with construction activities. No separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 01240
TRENCH EXCAVATION SAFETY

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all materials, equipment, and labor necessary to perform construction of all trench excavation protection systems to be utilized within the project as shown in the Drawings and specified within.

1.2 RELATED SECTIONS

A. Section 02650, PVC Pipe for Water Mains
B. Section 02660, Ductile Iron Pipe
C. Section 02665, HDPE Pipe
D. Section 02675, Pipe Encasement
E. Section 02680, Ductile Iron Fittings
F. Section 02690, Tapping Sleeves and Valves

1.3 REFERENCE STANDARDS

A. Latest provision of Part 1926, Subpart P- Excavations, Trenching, and Shoring of the Occupational Safety and Health Administration (OSHA) Standards and Interpretations, or the most applicable approved equal provision.

1.4 SUBMITTALS

A. Excavation Plan: Prior to start of excavation operations, submit a written plan to Engineer for review to demonstrate Contractor's compliance with OSHA Standard 29 CFR Part 1926.650 and Section 01240 of these Specifications. At a minimum, excavation plan shall include:

1. Name of competent person to be placed in charge of excavation and trenching operations.
2. Excavation method(s) or trench protective system(s) to be used.
3. Copies of "manufacturer's data" or other tabulated data if protective systems(s) are designed on the basis of such data.

PART 2 - PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 Trench excavation safety protection shall be accomplished as required by the latest provision of OSHA Standards, or the most applicable approved equal provision.

3.2 SHORING, SHEETING, BRACING, AND SLOPING

A. The Contractor shall provide shoring, sheeting, bracing, or sloping as required to protect excavations. All shoring, sheeting, bracing, and sloping will be installed and maintained in accordance with OSHA standards and other applicable laws.

B. For trench sheeting for pipes, no sheeting is to be withdrawn if driven below mid-diameter of any pipe, and no wood sheeting shall be cut off at a level lower than one (1) foot above the top of any pipe unless otherwise instructed by the Owner. If during the progress of the Work the Owner decides that additional wood sheeting should be left in place, he may instruct the Contractor in writing. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given for an alternate method of removal.

C. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. Unless otherwise approved or indicated in the Drawings, all sheeting and bracing shall be removed after completion of the substructure, care being taken not to disturb or otherwise injure the finished masonry. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, by watering or otherwise as may be required.

D. Owner has the right to instruct the Contractor with regard to sheeting and bracing to be left in place shall not be construed as creating any obligation on his part to issue such instructions, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or on the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

E. The Contractor shall construct cofferdams and sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing, and cofferdams shall be adequate to withstand all pressures to which the structure will be subjected. Pumping, bracing, and other work within the cofferdam shall be done in a manner to avoid disturbing any construction of the masonry enclosed. Any movement or bulging which may occur shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Trench Excavation Safety labor and materials are considered to be subsidiary to other pay items. No separate payment will be made to the Contractor for this Work.

4.2 PAYMENT: Trench Excavation Safety labor and materials are considered to be subsidiary to other pay items. No separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 01350
HYDROTESTING AND DISINFECTION

PART 1 – GENERAL

1.1 SCOPE

A. The Contractor shall furnish all labor, materials, equipment, appurtenances, and services required to clean, flush, disinfect, and hydrostatically test all interior surfaces of water main pipelines in accordance with these Specifications.

B. All structures containing water, including treatment units not subject to disinfection, shall be cleaned in accordance with Paragraph 3.3 of this Specification Section.

C. Water for initial hydrostatic testing and disinfecting will be furnished by the Owner.

D. Contractor shall provide all temporary piping, hoses, valves, appurtenances, pumps, and services as required.

E. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 02400, Valves and Appurtenances

B. Section 02440, Combination Air Valve

C. Section 02640, Fire Hydrant Assembly

D. Section 02650, PVC Pipe for Water Mains

E. Section 02660, Ductile Iron Pipe

F. Section 02665, HDPE Pipe

G. Section 02670, Ductile Iron Fittings

H. Section 02690, Tapping Sleeves and Valves

I. Section 02700, Water Main Tie-Ins

1.3 REFERENCE STANDARDS

A. Comply with the following applicable provisions and recommendations; the revision in effect at time of the bid opening shall apply.

1. AWWA C600 - Installation of Ductile Iron Mains and Their Appurtenances

2. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

3. AWWA C604 - Installation of Buried Steel Water Pipe- 4 In. and Larger

4. AWWA C651 - Disinfecting Water Mains
5. AWWA C652 - Disinfection of Water Storage Facilities
6. AWWA C653 - Disinfection of Water Treatment Plants

1.4 SUBMITTALS

A. Submit for approval the following:
   1. Hydrostatic testing and disinfection procedures, methods, coordination, and schedules.
   2. Related impacts on coordination with Owner's operations and Work Sequence.

PART 2 – PRODUCTS

2.1 DISINFECTANT

A. Before disinfection for use with potable water, the water main pipeline shall be filled to eliminate air pockets and flushed to remove particulates. The flushing velocity in the main shall not be less than 2.50 feet/second unless the Owner determines that conditions do not permit the required flow rate.

B. The Contractor shall disinfect all installed water mains in accordance with the requirements of AWWA C651.

C. Liquid chlorine, sodium hypochlorite or calcium hypochlorite shall be used in accordance with AWWA C652 and AWWA C653.

D. Liquid chlorine shall be used only where gas-flow chlorinators and injectors are installed for treatment applications. Portable or makeshift gas chlorination equipment is not acceptable.

E. Disinfectant chemicals and materials shall be furnished by the Contractor.

F. All disinfection of water mains and piping shall be done under general supervision of the Inspector.

PART 3 - EXECUTION

3.1 FLUSHING

A. Immediately upon completion of water main installation or repair Work, the Contractor shall flush all mains affected by the scope of the Work.

B. This flushing shall consist of completely filling sections of main between valves and then displacing such initial volumes of water by introducing clear water from existing facilities into and through the main to the point of discharge from the main being flushed.

C. The flow-through shall continue until it is determined all dust, debris, or foreign matter that may have entered during pipe laying operations has been flushed out.

D. All new water mains shall then be left under system pressure for testing.

E. To avoid damage to pavement and inconvenience to the public, fire hoses shall be used to direct flushing water from the main into suitable drainage channels or sewers.

F. The Contractor shall coordinate with the Inspector prior to beginning flushing activities.

3.2 CLEANING

A. All scaffolding, planks, tools, rags, dirt, debris, and any other material not part of the structural or operating facilities shall be removed prior to chlorination.

B. The surfaces of the walls, floors, and operating facilities shall then be thoroughly cleaned by sweeping, a high-pressure water hose, scrubbing, or another equally effective method.

C. All water, dirt, or foreign material accumulated in this operation shall be removed from the water storage facility.

3.3 CHLORINATION PROCEDURE

A. Facilities requiring disinfection shall be chlorinated by one of the following methods described in AWWA C652:

1. Method 1: Chlorination of treatment facilities such that at the end of the appropriate retention period the water will have a free chlorine residual of not less than 10 mg/l.

2. Method 2: Applying a solution of 200 mg/l available chlorine to the surfaces of all treatment facilities that will come in contact with water.

3. Method 3: Chlorination of treatment facilities with water having a free chlorine residual of 2 mg/l after 24 hours.

B. Contractor shall:

1. Provide all temporary taps, plugs, valves (including any necessary temporary valves to isolate new piping or structures from existing system), drains, pumps, piping, and connections required to clean, flush, disinfect, and remove the disinfectant.

2. Provide all temporary pumps, piping, and facilities, as required, to drain all flushing water to the work area runoff control area in accordance with the Contractor's Storm Water Pollution Prevention Plan (SWPPP).

3. Perform disinfection of each facility immediately before the facility is placed in operation and ensure that the facility is not contaminated after being acceptably disinfected.

3.4 BACTERIOLOGICAL SAMPLING AND TESTING

A. After the chlorination procedure is completed and before each facility is placed in service, water from the completed facility shall be sampled and tested by Owner for coliform organisms and odor.

B. Samples for bacteriological tests will be taken by the Owner. These samples

shall indicate microbiologically satisfactory water before the facilities will be accepted.

C. If initial test results indicate contamination is present, the Contractor shall repeat the cleaning and disinfection procedure until the test results indicate microbiologically satisfactory water.

D. The initial cleaning and disinfection procedures shall be performed at the Contractor's expense. The initial sampling and testing shall be at the Owner's expense. However, all expenses associated with subsequent cleaning, disinfection, sampling, and testing required due to positive bacteriological tests resulting from the Contractor's error or negligence shall be paid for by the Contractor. No extra payment or extension of Contract Times will be given to the Contractor for the time elapsed to achieve acceptable disinfection of the pipe.

E. Bacteriological tests will be completed in accordance with AWWA C652.

1. If a test is negative (satisfactory bacteriological sample), the facility may be placed in service.

2. If a test is positive, Owner will perform an additional set of tests to confirm the results of the initial tests.

3. If a repeat test for coliform organisms indicates positive results, the Contractor shall repeat the cleaning and disinfection procedure for the facility until satisfactory results are obtained.

3.5 HYDROSTATIC TESTING FOR PIPES

A. After the water pipeline has been laid and after inspection by the Owner, all newly laid main shall be subjected to a hydrostatic pressure test in accordance with AWWA C600/C605. The Contractor shall perform a hydrostatic pre-test to provide reasonable assurance of acceptance prior to performance of the witnessed test. Upon accomplishing a successful pre-test, the Contractor shall contact the Owner/Engineer at least 48 hours prior to the test. The Owner or the Inspector shall be present during all hydrostatic pipeline tests.

B. Testing shall not be performed before three (3) days after all portions of water mains installation work has been completed.

C. Proper measures shall be taken to ensure that no cross connections are made during testing activities.

D. Test Pressure: The hydrostatic test pressure shall be 1.5 times the anticipated maximum sustained working pressure of the line or 150 psi, whichever is higher. However, 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.

E. Slowly fill the pipe with water and allow it to stand for 24 hours. Expel all air from the main. Apply and maintain the specified test pressure by continuous pumping if necessary, for the entire test period. The test pressure shall be calculated for the point of lowest elevation, or as specified by the Owner. The pump suction shall be in a barrel or similar device or metered so that the amount of water required to maintain the test pressure may be measured accurately.

F. Each pressure test duration shall be a minimum of four (4) hours, and allowable

leakage shall be determined according to the following formula, unless otherwise directed by the Owner:

1. Leakage shall be defined as the quantity of makeup water required to hold the specified test pressure for the duration of the test period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour as determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

L = quantity of makeup water, in gallons per hour. S = length of pipe section being tested, in feet. D = nominal pipe diameter, in inches. P = average hydrostatic test pressure, in psi (gauge).

G. Test service connection pipe by either testing in conjunction with the main at the test pressure required for the main, or by testing at the normal hydrostatic main pressure after the main has been completely installed and tested. Inspect visually for leaks and repair any leaks before backfilling. Duration of the test shall be 15 minutes.

H. Upon completion and disinfection, the water mains shall be tested to determine water tightness according to AWWA C605 or most recent revision.

I. The hydrostatic pressure test must be successful. If the test is unsuccessful the contractor, at his expense, must rectify any problems and repeat the testing protocol.

3.6 HYDROSTATIC TESTING FOR TAPPING SLEEVES

A. Tapping tees shall be tested per manufacturer's recommendation. Inspect sleeve for leaks, and remedy leaks prior to tapping operation. The test pressure shall be maintained for a minimum of 10 minutes without any perceivable decline in pressure.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Unless shown on the Drawings or called out within the Specifications as a pay item, the hydrostatic testing and disinfection quantities shown or described are for informational purposes only. No separate measurement of hydrostatic testing and disinfection quantities will be made by the Contractor for this Work.

4.2 PAYMENT: Unless specified as a pay item, hydrostatic testing and disinfection performed and materials furnished in accordance with this Section will not be paid for directly but will be subsidiary to the pertinent items associated with construction activities. No separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 01410
TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, equipment, and incidentals required for testing laboratory services as specified herein.

1.2 DESCRIPTION OF REQUIREMENTS

A. The Owner will employ and pay for the services of an Independent Testing Laboratory to perform specified services and testing.

B. Employment of the laboratory shall in no way relieve the Contractor's obligations to perform the Work of the Contract.

1.3 QUALIFICATION OF LABORATORY

A. Authorized to operate in the State of Texas.

1.4 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

1.5 REFERANCE STANDARDS

A. Laboratory of National Institute of Standards and Technology (NIST).

1.6 SUBMITTALS

A. Submit a copy of report of inspection of facilities made by Materials Reference Laboratory of National Institute of Standards and Technology (NIST) during the most recent tour of inspection, with memorandum of remedies of any deficiencies reported by the inspection.

PART 2 – TESTING EQUIPMENT

2.1 GENERAL

A. Calibrated at reasonable intervals by devices of accuracy traceable to either:

1. NIST
2. Accepted values of natural physical constants.

PART 3 - EXECUTION

3.1 LABORATORY DUTIES

A. Cooperate with Engineer and Contractor to provide qualified personnel after due notice.
B. Perform specified inspections, sampling and testing of materials and methods of construction.
C. Comply with specified standards.
D. Promptly notify Engineer/Owner and Contractor of observed irregularities or deficiencies of work products.
E. Promptly submit written report of each test and inspection; one copy each to Engineer, Owner and Contractor. Each report shall include:

1. Date issued.
2. Project title and number.
3. Testing laboratory name, address and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Record of temperature and weather conditions.
7. Date of test.
8. Identification of product and specification section.
9. Location of sample or test in the Project.
10. Type of inspection or test.
11. Results of tests and compliance with Contract Documents.
12. Interpretation of test results, when requested by Engineer.
13. Employment of personnel making test samples.
14. Perform additional tests as required by Engineer or the Owner.

3.2 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or expand requirements of the Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Contractor.

3.3 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to Work, and to Manufacturer's operations.
B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
C. Furnish copies of Products test reports as required.

D. Furnish incidental labor and facilities.

E. Provide access to Work to be tested.

F. Obtain and handle samples at the Project site or at the source of the product to be tested.

G. Facilitate inspections and tests.

H. Provide a suitable storage box at the site for storage and curing of test samples.

I. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

J. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.

K. Make arrangements with laboratory and pay for additional samples and tests required for Contractor's convenience, including concrete design mixes.

L. Pay for the services of the Independent Testing Laboratory to perform additional inspections, sampling, and testing required when initial tests indicate that work does not comply with the Contract Documents.

PART 4 – MEASUREMENT AND PAYMENT

4.1 Measurement and payment shall be the sole responsibility of the Owner. No separate measurement shall be done by, or payment made to, the Contractor for this Work.

END OF SECTION

SECTION 01500
CONCRETE FOR STRUCTURES

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section shall consist of furnishing all material, storage, handling, proportioning, and mixing of materials for Portland cement concrete construction of buildings, bridges, culverts, slabs, prestressed concrete, and incidental appurtenances.

B. The Work in this section shall also include the furnishing and placing of reinforcing steel, deformed smooth, of the size and quantity specified in the Drawings.

C. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of said standards or code shall govern.

1.2 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) International

B. Texas Department of Transportation (TxDOT)

C. American Association of State Highway and Transportation Officials (AASHTO)

1.3 SUBMITTALS

A. The Contractor shall submit the manufacturer's product data, instructions, recommendations, shop drawings, and certifications. All submittals shall be in accordance with the Engineer's requirements and submittals shall be approved prior to delivery.

1. Submit proposed mix design and test data for each type and strength of concrete in the Work.

2. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by Engineer.

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

A. Concrete shall be composed of Portland cement or Portland cement and fly ash, water, aggregates (fine and coarse), and admixtures proportioned and mixed as hereinafter provided to achieve specified results.

1. Cementitious Materials: Portland cement shall conform to ASTM C 150, Type I (General Purpose), Type II (General Purpose with Moderate Sulfate Resistance) and Type III (High Early Strength). Type I shall be used when none is specified. Type I and Type III shall not be used when Type II is specified. Type III may be used in lieu of Type I when the anticipated air temperature for the succeeding 12 hours will not exceed 60oF. All cement shall be of the same type and from the same source for a monolithic placement.

2. Mixing Water: Water for use in concrete and for curing shall be potable water free of oils, acids, organic matter, or other deleterious substances and shall not contain more than 1,000 parts per million of chlorides as Cl or sulfates as SO4.Contractor may request approval of water from other sources. Contractor shall arrange for samples to be taken from the source and tested at his expense. Water quality tests shall conform to AASHTO Method T 26 except where such methods are in conflict with provisions of this specification.

3. Coarse Aggregate

   a. Coarse aggregate shall consist of durable particles of crushed or uncrushed gravel, crushed blast furnace slag, crushed stone or combinations thereof; free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material either free or as an adherent coating. It shall not contain more than 0.25 percent by weight of clay lumps, nor more than 1.0 percent by weight of shale nor more than 5 percent by weight of laminated and/or friable particles when tested in accordance with TxDOT Test Method TEX-413-A. It shall have a wear of not more than 40 percent when tested in accordance with TxDOT Test Method TEX-410-A.

   b. Unless otherwise indicated, coarse aggregate shall be subjected to 5 cycles of the soundness test conforming to TxDOT Test Method TEX-411-A. The loss shall not be greater than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

   c. Coarse aggregate shall be washed. The Loss by Decantation (TxDOT Test Method TEX- 406-A), plus allowable weight of clay lumps, shall not exceed 1 percent or value indicated on the plans or in the project manual, whichever is less. If material finer than the # 200 sieve is definitely established to be dust of fracture of aggregates made primarily from crushing of stone, essentially free from clay or shale as established by TxDOT Test Method TEX-406-A, the percent may be increased to 1.5.The coarse aggregate factor may not be more than 0.82; however, when voids in the coarse aggregate exceed 48 percent of the total rodded volume, the coarse aggregate factor shall not exceed 0.85. The coarse aggregate factor may not be less than 0.68 except for a Class I machine extruded mix that shall not have a coarse aggregate factor not lower than 0.61.

   d. When exposed aggregate surfaces are required, the coarse aggregate shall consist of particles with at least 40 percent crushed faces. Uncrushed gravel, polished aggregates and clear resilient coatings are not acceptable for exposed aggregate pedestrian surfaces (i.e., sidewalks, driveways, medians, islands, etc.). Grade 5 aggregates shall be used for exposed aggregate finishes.

   e. When tested by approved methods, the coarse aggregate including combinations of aggregates when used, shall conform to the grading requirements shown in Table 1.

Table 1: Coarse Aggregate Gradation Chart (TEX 401-A, Percent Retained)										
Grade	Nom. Size	2-1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8
1	2 1/2"	0	0-20	15-50		60-80			95-100	
2	1 1/2"		0	0-5		30-65		70-90	95-100	
3	1"		0	0-5		10-40	40-75		95-100	
4	1”			0	0-5		40-75		90-100	95-100
5	3/4”				0	0-10		45-80	90-100	95-100

f. Fine aggregate shall consist of clean, hard, durable, and uncoated particles of natural or manufactured sand or a combination thereof, with or without a mineral filler. It shall be free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material and it shall not contain more than 0.5 percent by weight of clay lumps. When subjected to color test for organic impurities per TxDOT Test Method TEX-408-A, it shall not show a color darker than standard.

g. Acid insoluble residue of fine aggregate used in slab concrete subject to direct traffic shall not be less than 28 percent by weight when tested conforming to TxDOT Test Method TEX-612-J.

h. When tested by approved methods, the fine aggregate, including combinations of aggregates, when used, shall conform to the grading requirements shown in Table 2.

Table 2: Fine Aggregate Gradation Chart (TEX 401-A, Percent Retained)							
3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
0	0-5	0-20	15-50	35-75	65-90	90-100	97-100

i. Where sand equivalence is greater than 85, retainage on No. 50 sieve may be 65 to 94 percent. Where manufactured sand is used in lieu of natural sand, the percent retained on No. 200 sieve shall be 94 to 100. Sand equivalent per TxDOT Test.

j. Method TEX-203-F shall not be less than 80 nor less than otherwise indicated, whichever is greater. The fineness modulus will be determined by adding the percentages by weight retained on sieve Nos. 4, 8, 16, 30, 50 and 100 and dividing the sum of the six sieves by 100. For Class A and C concrete, the fineness modulus shall be between 2.30 and 3.10. For Class H concrete, the fineness modulus shall be between 2.40 and 2.90.

k. Mineral filler shall consist of stone dust, clean crushed sand, approved fly ash or other approved inert material.

l. Mortar (Grout) for repair of concrete shall consist of 1 part cement, 2 parts finely graded sand and enough water to make the mixture plastic. When required to prevent color difference, white cement shall be added to produce color required. When required by the Engineer,

an approved latex adhesive shall be added to the mortar.

m. All admixtures shall comply with the requirements of Specification Section 01510 within these Specifications. Calcium chloride-based admixtures shall not be approved.

2.2 STORAGE OF CEMENT AND FLY ASH

A. Cement and fly ash shall be stored in separate and well ventilated, weatherproof buildings or approved bins which will protect the material from dampness or absorption of moisture. Storage facilities shall be easily accessible, and each shipment of packaged cement shall be kept separated to provide for identification and inspection. Engineer may permit small quantities of sacked cement to be stored in the open for a maximum of 48 hours on a raised platform and under waterproof covering.

2.3 STORAGE OF AGGREGATES

A. Aggregates shall be stockpiled in sizes to facilitate blending. If the aggregate is not stockpiled on a hard, non-contaminant base, the bottom 6-inch layer of the stockpile shall not be used without recleaning the aggregate. Where space is limited, stockpiles shall be separated by walls or other appropriate barriers. Aggregate shall be stockpiled and protected from the weather a minimum of 24 hours prior to use to minimize free moisture content. When stockpiles are too large to protect from the weather, accurate and continuous means acceptable to the Engineer shall be provided to monitor aggregate temperature and moisture. Aggregates shall be stockpiled and handled such that segregation and contamination are minimized.

2.4 MEASUREMENT OF MATERIALS

A. Water shall be accurately metered. Fine and coarse aggregates, mineral filler, bulk cement and fly ash shall be weighed separately. Allowances shall be made in the water volume and aggregate weights during batching for moisture content of aggregates and admixtures. Volumetric and weight measuring devices shall be acceptable to Engineer. Batch weighing of sacked cement is not required; however, bags, individually and entire shipments, may not vary by more than 3 percent from the specified weight of 94 pounds per bag. The average bag weight of a shipment shall be determined by weighing 50 bags taken at random.

2.5 MIX DESIGN

A. Contractor shall furnish a mix design acceptable to the Engineer for class of concrete specified. The mix shall be designed by a qualified commercial laboratory and signed/sealed by a Texas-registered Professional Engineer to conform with requirements contained herein, to ACI 211.1 or TxDOT Bulletin C-11 (and supplements thereto). Contractor shall perform, at his own expense, the work required to substantiate the design, including testing of strength specimens. Complete concrete design data shall be submitted to the Engineer for approval. The mix design will be valid for a period of one (1) year provided that there are no changes to the component materials.

B. At the end of one (1) year, a previously approved mix may be resubmitted for approval if it can be shown that no substantial change in the component materials

has occurred. The resubmittal analysis must be reviewed, signed and sealed by a Texas-registered Professional Engineer. This resubmittal will include a reanalysis of specific gravity, absorption, fineness modulus, sand equivalent, soundness, wear and unit weights of the aggregates. Provided that the fineness modulus did not deviate by more than 0.20 or that the reproportioned total mixing water, aggregate and cement (or cement plus fly ash) are within 1, 2, and 3 percent, respectively, of pre-approved quantities, a one-year extension on the approval of the mix may be granted by the Engineer. Updated cement, fly ash, and admixture certifications shall accompany the resubmittal.

C. Approved admixtures conforming to Specification Section 01510 within these Specifications may be used with all classes of concrete at the option of the Contractor provided that specific requirements of the governing concrete structure specification are met. Water reducing and retarding agents shall be required for hot weather, large mass, and continuous slab placements. Air entraining agents may be used in all mixes but must be used in the classes indicated on Table 4. Unless approved by the Engineer, mix designs shall not exceed air contents for extreme exposure conditions as recommended by ACI 211.1 for the various aggregate grades.

2.6 CONSISTENCY AND QUALITY OF CONCRETE

A. Consistency and quality of concrete should allow efficient placement and completion of finishing operations before initial set. Retempering shall not be allowed. When field conditions are such that additional moisture is needed for final concrete surface finishing operation, required water shall be applied to surface by fog spray only and shall be held to a minimum. Concrete shall be workable, cohesive, possess satisfactory finishing qualities and of stiffest consistency that can be placed and vibrated into a homogeneous mass within slump requirements specified in Table 3. Excessive bleeding shall be avoided and in no case will it be permissible to expedite finishing and drying by sprinkling the surface with cement powder. No concrete will be permitted with a slump in excess of the maximums shown unless water-reducing admixtures have been previously approved. Slump values shall conform to TxDOT Test Method TEX-415-A.

Table 3: Slump Requirements

	Slump, inches	
Type of Construction	Maximum	Minimum
Cased Drilled Shafts	4	3
Reinforced Foundation Caissons and Footings	3	1
Reinforced Footings and Substructure Walls	3	1
Uncased Drilled Shafts	6	5
Thin-walled Sections (9 inches or less)	5	4
Prestressed Concrete Members	5	4
Precast Drainage Structures	6	4
Wall Sections over 9 inches	4	3
Reinforced Building Slabs, Beams, Columns and Walls	4	1
Bridge Decks	4	2
Pavements, Fixed-form	3	1
Pavements, Slip-form	1-1/2	1/2
Sidewalks, Driveways and Slabs on Ground	4	2

Curb & Gutter, Hand-vibrated	3	1
Curb & Gutter, Hand-tamped or spaded	4	2
Curb & Gutter, Slip-form/extrusion machine	2	1/2
Heavy Mass Construction	2	1
High Strength Concrete	4	3
Riprap and Other Miscellaneous Concrete	6	1
Under Water or Seal Concrete	6	5

B. During progress of the work, Engineer or Owner's testing laboratory shall cast test cylinders and/or beams as a check on compressive and/or flexural strength of concrete actually placed. Engineer or Utility's testing laboratory may also perform slump tests, entrained air tests and temperature checks to ensure compliance with specifications.

C. Proportioning of all material components shall be checked prior to discharging. Excluding mortar material for pre-coating of the mixer drum [403.8(2)] and adjustment for moisture content of admixtures and aggregates, material components shall fall within the range of ± 1% for water, ± 2% for aggregates, ± 3% for cement, -2% for fly ash and within manufacturer recommended dosage rates for admixtures except that air entrainment shall be ± 1-1/2 points of the mix design requirements.

D. Unless otherwise specified, concrete mix temperature shall not exceed 90° F except in mixes with high range water reducers where a maximum mix temperature of 100° F will be allowed. Cooling an otherwise acceptable mix by addition of water or ice will not be allowed.

E. Test beams or cylinders will be required for small placements such as manholes, inlets, culverts, wing walls, etc. Engineer may vary the number of tests to a minimum of 1 for each 25 cubic yards placed over a several day period.

F. Test beams or cylinders shall be required for each monolithic placement of bridge decks or superstructures, top slabs of direct traffic culverts, cased drilled shafts, structural beams and as otherwise directed by Engineer for design strength or early form removal.

G. Test beams or cylinders made for early form removal or use of structure will be at Contractor's expense, except when required by Engineer.

H. A strength test shall be defined as the average of breaking strength of 2 cylinders or 2 beams as applicable. Specimens will be tested conforming to TxDOT Test Method TEX- 418-A or TEX-420-A. If required strength or consistency of class of concrete being produced cannot be secured with minimum cementitious material specified or without exceeding maximum water/cementitious material ratio, Contractor will be required to furnish different aggregates, use a water reducing agent, an air entraining agent or increase cementitious material content in order to provide concrete meeting these specifications. Test specimens shall be cured using the same methods and under the same conditions as the concrete represented. Design strength beams and cylinders shall be cured conforming to TxDOT Bulletin C-11 (and supplements thereto).

I. When control of concrete quality is by 28-day compressive tests, job control will be by 7- day compressive strength tests. The minimum strength requirement for seven (7) day test will be 70- percent of the specified minimum 28-day compressive strength. If the required 7-day strength is not secured with the quantity of cement

specified in Table 4, changes in the mix design shall be made and resubmitted for approval.

Table 4: Classes of Concrete

Class	Sk Cement Per CY	Minimum Strength 28 Day (psi)	Minimum Strength 7 Day (psi)	*Maximum W/C Ratio	Coarse Agg. Number	** Air Ent.
A	5.0	3000	2100	0.6	1,2,3,4,5	Yes
B	4.0	2000	1400	0.6	2,3,4,5	No
C	6.0	3600	2520	0.45	1,2,3,4,5	Yes
D	4.5	2500	1750	0.6	2,3,4	No
H	6.0	As indicated	As Indicated	0.45	3,4	Yes
I	5.5	3500	2450	0.45	2,3,4,5	Yes
J	2.0	800	560	N/A	2,3,4,5	No
S	6.0	4000	2800	0.45	2,3,4,5	Yes

Notes:

1. Grade 1 coarse aggregate may be used in massive foundations only (except case drilled shafts) with 4 inch minimum clear spacing between reinforcing steel.
2. When Type II cement is used in Class C, S or A concrete, the 7-day compressive strength requirement will be 2310 psi for Class C, 2570 psi for Class S, and 1925 psi for Class A, minimum.
3. *The design water-cement ratio shall be appropriately adjusted for mixes with fly ash per ACI 211.1 or TxDOT C-11 (and supplements thereto), as applicable.
4. **Maximum air design contents for the five grades of coarse aggregate, unless otherwise approved by Engineer, are: 4.5% for Grade 1, 5.5% for Grade 2, and 6.0% for Grades 3, 4, and 5.

2.7 MIXING AND MIXING EQUIPMENT

A. All equipment, tools and machinery used for hauling materials and performing any part of the work shall be maintained in such condition to insure completion of the work without excessive delays. Mixing shall be done in a mixer of approved type and size that will produce uniform distribution of material throughout the mass and shall be capable of producing concrete meeting requirements of ASTM C 94, Ready-mixed Concrete, and these specifications. Mixing equipment shall be capable of producing sufficient concrete to provide required quantities. Entire contents of the drum shall be discharged before any materials are placed therein for a succeeding batch. Improperly mixed concrete shall not be placed in a structure. The mixer may be batched by either volumetric or weight sensing equipment and shall be equipped with a suitable timing device that will lock the discharging mechanism and signal when specified time of mixing has elapsed.

1. Proportioning and Mixing Equipment

   a. For all miscellaneous concrete placements, a mobile, continuous, volumetric mixer or a volumetric or weight batch mixer of the rotating paddle type may be used.

   b. When approved by Engineer in writing or when specified for use, these mixers may be used for other types of concrete construction, including structural concrete, if the number of mixers furnished will

supply the amount of concrete required for the operation in question.

c. These mixers shall be designed to receive all the concrete ingredients, including admixtures, required by the mix design in a continuous uniform rate and mix them to the required consistency before discharging. Mixers shall have adequate water supply and metering devices.

d. For continuous volumetric mixers, the materials delivered during a revolution of the driving mechanism or in a selected interval, will be considered a batch and the proportion of each ingredient will be calculated in the same manner as for a batch type plant.

e. Mixing time shall conform to recommendations of manufacturer of mixer unless otherwise directed by Engineer.

2. Ready-mixed Concrete: Use of ready-mixed concrete will be permitted provided the batching plant and mixer trucks meet quality requirements specified herein. When ready-mixed concrete is used, additional mortar (1 sack cement, 3 parts sand and sufficient water) shall be added to each batch to coat the mixer drum. Ready-mixed concrete, batching plant and mixer truck operation shall include the following:

a. A ticket system will be used that includes a copy for the Inspector. Ticket will have machine stamped time/date of concrete batch, weight of cement, fly ash, sand and aggregates, exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on ticket may be cause for rejection of concrete.

b. Sufficient trucks will be available to support continuous placements. Contractor will satisfy Engineer that adequate standby trucks are available to support monolithic placement requirements.

c. A portion of mixing water required by the mix design to produce the specified slump may be withheld and added at the job site, but only with permission of Engineer and under the Inspector's observation. When water is added under these conditions, it will be thoroughly mixed before any slump or strength samples are taken. Additional cement shall not be added at the job site to otherwise unacceptable mixes.

d. A metal plate(s) shall be attached in a prominent place on each truck mixer plainly showing the various uses for which it was designed. The data shall include the drum's speed of rotation for mixing and for agitating and the capacity for complete mixing and/or agitating only. A copy of the manufacturer's design, showing dimensions of blades, shall be available for inspection at the plant at all times. Accumulations of hardened concrete shall be removed to the satisfaction of the Engineer or Owner.

e. The loading of the transit mixers shall not exceed capacity as shown on the manufacturer's plate attached to the mixer or 63 percent of the drum volume, whichever is the lesser volume. The loading of transit mixers to the extent of causing spill-out enroute to delivery will not be acceptable. Consistent spillage will be cause for disqualification of a supplier.

f. Excess concrete remaining in the drum after delivery and wash water after delivery shall not be dumped on the project site unless approval of the dump location is first secured from the Engineer or Owner.

3. Hand-mixed Concrete

a. Hand mixing of concrete may be permitted for small placements or in case of an emergency and then only on authorization of the Engineer. Hand-mixed batches shall not exceed a 4 cubic foot batch in volume. Material volume ratios shall not be leaner than 1 part cement, 2 parts large aggregate, 1 part fine aggregate and enough water to produce a consistent mix with a slump not to exceed 4 inches. Admixtures shall not be used unless specifically approved by the Engineer.

2.8 REINFORCED STEEL

A. Bars

1. Bar reinforcement shall be deformed and shall conform to ASTM A 615, A 616, Grades 40, 60 or 75 and shall be open-hearth, basic oxygen or electric furnace new billet steel, unless otherwise indicated. Large diameter new billet steel (Nos. 14 and 18), Grade 75, will be permitted for straight bars only.

2. Where bending of bar sizes No. 14 or No. 18 of Grades 40 or 60 is required, bend testing shall be performed on representative specimens as described for smaller bars in the applicable ASTM specification. The required bend shall be 90 degrees at a minimum temperature of 60 F around a pin having a diameter of 10 times the nominal diameter of the bar and shall be free of cracking.

3. Spiral reinforcement shall be either smooth or deformed bars or wire of the minimum diameter indicated. Bars for spiral reinforcement shall comply with ASTM A 675, A 615 or A 617. Wire shall comply with ASTM A 82. The minimum yield strength for spiral reinforcement shall be 40,000 psi.

4. In cases where the provisions of this item are in conflict with the provisions of the ASTM Designation to which reference is made, the provisions of this item shall govern.

5. Report of chemical analysis showing the percentages of carbon, manganese, phosphorus and sulphur will be required for all reinforcing steel when it is to be welded, except for drill shafts. No tack welding will be allowed. All welding shall conform to the requirements of AWS D-1-72.

6. Smooth bars, larger than No. 4, may be steel conforming to the above or may be furnished in any steel that meets the physical requirements of ASTM A 36.

7. Smooth, round bars shall be designated by size number through No.4. Smooth bars above No. 4 shall be designated by diameter in inches.

8. The nominal size and area and the theoretical weight (lbs.) of reinforcing steel bars covered by these specifications are as follows:

Table 5: Reinforced Steel Bars			
Bar Size Number	**Nominal Diameter (inches)**	**Nominal Area (Square Inches)**	**Weight/ Linear Foot**
2	0.250	0.05	0.167
3	0.375	00.11	0.376
4	0.500	0.20	0.668
5	0.625	0.31	1.043
6	0.750	0.44	1.502
7	0.875	0.875	2.044
8	1.000	0.79	2.670
9	1.128	1.00	3.400
10	1.270	1.27	4.303
11	1.410	1.56	5.313
14	1.693	2.25	7.65
18	2.257	4.00	13.60

B. Placing

1. Reinforcement shall be placed as near as possible in the position indicated. Unless otherwise indicated, dimensions shown for reinforcement are to the centers of the bars. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of the spacing between bars. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch. Cover of concrete to the nearest surface of steel shall be as follows:

Table 6: Reinforced Steel Minimum Cover	
Description	**Minimum Cover (inches)**
(a) Concrete cast against and permanently exposed to earth	3
(b) Concrete exposed to earth or weather	
Bar No. 6 through 18 bars	2
(c) Concrete not exposed to weather or in contact with ground:	
Slabs, walls, joists:	
Bar No. 14 and 18 1 1/2	1-1/2
Bar No. 11 and smaller 1	1

PART 3 - MEASUREMENT AND PAYMENT

3.1 MEASUREMENT

A. The quantities of concrete of the various classifications which constitute the completed and accepted structure or structures in place will be measured by the cubic yard, each, square foot, square yard or linear foot as indicated in the Drawings. Measurement will be as follows:

1. General

a. Measurement based on dimensions shall be for the completed structure as measured in place. However, field-measured dimensions shall not exceed those indicated on the plans or as may have been directed by the Engineer in writing.

b. No deductions shall be made for chamfers less than 2 inches in depth, embedded portions of structural steel, reinforcing steel, nuts, bolts, conduits less than 5 inches in diameter, pre/post tensioning tendons, keys, water stops, weep holes and expansion joints 2 inches or less in width.

c. No measurement shall be made for concrete keys between adjoining beams or prestressed concrete planks.

d. No measurement shall be made for fill concrete between the ends or adjoining prestressed concrete planks/box beams at bent caps or between the ends of prestressed concrete planks/box beams and abutment end walls.

e. No measurement shall be made for inlet and junction box invert

concrete.

f. No measurement shall be made for any additional concrete required above the normal slab thickness for camber or crown.

g. No measurement shall be made for reinforced steel unless it is included as a separate bid item in the contract documents.

3.2 PAYMENT: Payment will be made for the Work completed per the bid item unit as described above. The unit bid price shall include labor, equipment, materials, time and incidentals necessary to complete the Work.

END OF SECTION

SECTION 01510
CONCRETE ADMIXTURES

PART 1 - GENERAL

1.1 SCOPE

A. The Work in this Section consists of materials requirements of admixtures for Portland cement concrete.

B. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 01500, Concrete for Structures

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) International

B. Texas Department of Transportation (TxDOT)

1.4 SUBMITTALS

A. All admixture submittals must be approved by the Engineer. No admixture shall be chloride-based or have chloride(s) added in the manufacturing process. Admixtures must be pretested by the TxDOT Materials and Tests Engineer and be included in the State's current approved admixture list. All admixtures must retain an approved status through the duration of a mix design's one-year approval period.

PART 2 - PRODUCTS

2.1 Air Entraining Admixture: An "Air Entraining Admixture" is defined as a material which, when added to a concrete mixture in the proper quantity, will entrain uniformly dispersed microscopic air bubbles in the concrete mix. The admixture shall meet the requirements of ASTM Designation: C 260 modified as follows:

A. The cement used in any series of test shall be either the cement proposed for the specific work or a "reference" Type I cement from one mill.

B. The air entraining admixture used in the reference concrete shall be Neutralized Vinsol Resin.

2.2 Water-Reducing Admixture: A "Water-reducing Admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency and required strength. This admixture shall conform to ASTM C 494, Type A.

2.3 Accelerating Admixture: An "Accelerating Admixture" is defined as an admixture that accelerates the setting time and the early strength development of concrete. This

admixture shall conform to ASTM C 494, Type C. The accelerating admixture will contain no chlorides.

2.4 Water-reducing, Retarding Admixture: A "Water-reducing, Retarding Admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency and retard the initial set of the concrete. This admixture shall conform to ASTM C 494, Type D.

2.5 High-range Water Reducing Admixtures: A "High-range Water Reducing Admixture", referred to as a superplasticizer, is defined as a synthetic polymer material which, when added to a low slump concrete mixture increases the slump without adversely affecting segregation, impermeability, or durability of the mix. This admixture shall conform to ASTM C 494, Type F or G.

2.6 Fly Ash: Fly ash used in Portland cement concrete as a substitute for Portland cement or as a mineral filler shall comply with TXDOT Materials Specification D-9-8900 and be listed on TXDOT's current list of approved fly ash sources. Fly ash obtained from a source using a process fueled by hazardous waste (30 Texas Administrative Code, Section 335.1) shall be prohibited. This applies to any other specification concerning the use of fly ash. Contractor shall maintain a record of source for each batch. Supplier shall certify that no hazardous waste is used in the fuel mix or raw materials.

2.7 Certification and Product Information

A. The Contractor shall submit the name of the admixture proposed and manufacturer’s certification that the selected admixtures meet the requirements of this item and of ASTM C 260 and C 494 as applicable. Admixtures for a mix design shall be of the same brand. If more than one admixture is proposed in the concrete mix, a statement of compatibility of components shall accompany certification. Manufacturer’s product literature shall specify when in the batching/mixing operation the admixture must be added.

B. The Engineer may request additional information such as infrared spectrophotometry scan, solids content, pH value, etc., for further consideration. Any unreported changes in formulation discovered by any of the tests prescribed herein may be cause to permanently bar the manufacturer from furnishing admixtures for Owner's work.

2.8 Construction Use of Admixtures

A. All mixtures used shall be liquid except high-range water reducers, which may be a powder. Liquid admixtures shall be agitated as needed to prevent separation or sedimentation of solids; however, air agitation of Neutralized Vinsol Resin will not be allowed.

B. No admixture shall be dispensed on dry aggregates. Admixtures shall be dispensed at the batching site separately, but at the same time as the mixing water. Only high range water reducers may be introduced into the mix at the job site.

C. When other admixtures are used with fly ash, the amount of the other admixture to be used shall be based on the amount of Portland cement only and not the amount of Portland cement and fly ash.

D. When high-range water reducers are to be added at the job site, transit mixers shall be used. Admixture manufacturer literature shall indicate recommended mixing methods and time for the specific equipment and mix design used. The transit mix equipment shall not be loaded in excess of 63 percent of its rated capacity to ensure proper mixing of the admixture at the site. If during discharging of concrete a change in slump in excess of 30% is noted, the remaining concrete shall be rejected unless prior approval was given by the Engineer to retemper a load with a second charge of admixture. Retempering with water shall not be allowed.

E. Accelerating admixtures will not be permitted in combination with Type II cement.

F. All mixes with air entrainment shall have a minimum relative durability factor of 80 in accordance with ASTM C 260. Dosage of air entrainment admixtures may be adjusted by the Contractor to stay within the specified tolerances for air entrainment requirements within Section 1500 of these Specifications.

PART 3 – MEASUREMENT AN PAYMENT

4.1 MEASUREMENT: Unless shown on the Drawings or called out within the Specifications as a pay item, admixtures quantities shown or described are for informational purposes only. No separate measurement for admixture quantities will be made by the Contractor for this Work.

4.2 PAYMENT: Unless specified as a pay item, admixtures furnished in accordance with this Section will not be paid for directly but will be subsidiary to the pertinent items associated with construction activities. No separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 01600

CONCRETE ENCASEMENT, CRADLES, CAPS AND SEALS

PART 1 – G E N E R A L

1.1 SCOPE

A. The Work in this Section consists of furnishing all labor, materials, equipment, and incidentals for placing of concrete encasements, cradles, caps, and seals on either existing or proposed water and sewer mains, as shown in the Drawings.

B. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 01500, Concrete for Structures

1.3 REFERENCE STANDARDS

A. Texas Commission of Environmental Quality (TCEQ)

1. Chapter 217 – Design for Domestic Wastewater Systems

B. American Society for Testing and Materials (ASTM) International

1. ASTM C 138 - Standard Test Method for Unit Weight, Yield and Air Content (Gravimetric) of Concrete.
2. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.
3. ASTM C 150 - Standard Specification for Portland Cement.
4. ASTM C 494 - Standard Specification for Chemical Admixture for Concrete.
5. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcinated Natural Pozzolan for use as Mineral Admixture in Portland Cement Concrete.
6. ASTM C 869 - Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.
7. ASTM C 937 - Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.
8. ASTM C 942 - Standard Test Method for Compressive Strength of Grout for Pre-placed Aggregate Concrete into Laboratory.
9. ASTM C 1017 - Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.

PART 2 – P R O D U C T S

2.1 MATERIALS

A. Concrete Class D shall confirm to all requirements of Section 01500 of these Project Specifications.

PART 3 – CONSTRUCTION

3.1 When trench foundation is excessively wet or unstable or installation of water or wastewater main will result in less than 36 inches of cover, Contractor shall notify Engineer. The Engineer may require Contractor to install a concrete seal, cradle, cap, encasement, or other appropriate action.

3.2 Concrete Encasement: Concrete encasement shall be installed when shown in the Drawings. The trench shall be excavated and fine graded to a depth conforming to the Concrete Encasement Detail as shown in the Drawings.

A. The water main or sewer main shall be supported by precast concrete blocks of the same strength as the concrete for encasement and securely tied down to prevent floatation.

B. Encasement shall be placed to a depth and width conforming to the details and sections shown in the Drawings.

3.3 Concrete Cradles: Concrete cradles shall be installed when shown in the Drawings. The trench shall be prepared and the main supported. Straps and tie downs shall be a minimum of No. 4 diameter rebar.

3.4 Concrete Caps: Concrete caps shall be installed when shown in the Drawings.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot of concrete encasement, cradles, caps, and seals installed as accepted by the Owner for the size of the pipe specified.

4.2 PAYMENT: Payment shall be full compensation for the labor, materials, and installation of concrete encasement, cradles, caps, and seals. This item shall include, but not necessarily be limited to: carrier pipe, concrete encasement, cradle, caps, seals, tracer wire, marker tape, excavation and backfill, compaction, bracing, sheeting, and shoring; grout; compaction; hydrotesting and disinfection; and all other incidental work for the concrete encasement, cradles, caps, and seals, complete in place.

END OF SECTION

SECTION 01700
SITE RESTORATION

PART 1 – GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, and equipment for preparing and spreading topsoil, fertilizer, seeding, and mulch as shown in the Drawings and specified herein.

B. The Work included in this Section shall also include site restoration of soils to original grade along pipeline installations.

C. Where references are made to other standards or codes, unless specified date references are indicated, the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 01100, Site Preparation

1.3 REFERENCE STANDARDS

A. Comply with the applicable provisions and recommendations, except where otherwise shown or specified.

1. Association of Official Analytical Chemists, Official Methods of Analysis.
2. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
3. FSO-F-241D, Fertilizer, Mixed, Commercial.

1.4 SUBMITTALS

A. The Contractor shall submit certification from supplier that each type of seed conforms to this Section's requirements and the requirements of the Texas Seed Law.

B. The Contractor shall submit certification stating that the fertilizer complies with this Section's requirements and the requirements of the Texas Fertilizer Law.

1.5 PRODUCT DELIVERY STORAGE, AND HANDLING

A. Materials shall be delivered in proper containers and protect materials from deterioration during delivery.

B. Store and cover material to prevent deterioration. Remove packaged materials which have become damaged or show deterioration from the site.

PART 2 – MATERIALS

2.1 TOPSOIL

A. Topsoil shall be reasonably free from subsoil, stumps, roots, brush, stones (2 inches or more in diameter), clay lumps or similar objects.

B. The topsoil and or soil mixture, unless otherwise specified or approved, shall have a pH range of approximately 5.5 to 8.0.

C. The organic content of topsoil shall be not less than 1%.

2.2 GRASS SEED

A. Grass seed shall conform to the U.S. Department of Agriculture rules and regulations of the Federal Seed Act and the Texas Seed Law.

B. Seed shall be certified 90 percent pure and furnish 80 percent germination and meet the following requirements:

1. Rye: Fresh, clean, Italian rye grass seed (lollium multi-florum), mixed in labeled proportions. As tested, minimum percentages of impurities and germination must be labeled. Deliver in original unopened containers.

2. Bermuda: Extra-fancy, treated, lawn type common Bermuda (Cynodon dactylon). Deliver in original, unopened container showing weight, analysis, name of vendor, and germination test results.

3. Wet, moldy, or otherwise damaged seed will not be accepted.

4. Seed requirements, application rates and planting dates are:

Type	Application Rate (pounds/acre)	Planting Date
Hulled Common Bermuda Grass 98/88 Unhulled Common Bermuda Grass 98/88	40/40	Jan 1 to Mar 31
Hulled Common Bermuda Grass 98/88	40	Apr 1 to Sep 30
Hulled Common Bermuda 98/88 Unhulled Common Bermuda Grass 98/88 Annual Rye Grass (Gulf)	40/40/30	Oct 1 to Dec 31

2.4 FERTILIZER

A. Fertilizer shall be dry and free flowing, inorganic, water soluble commercial fertilizer, which is uniform is composition. Caked, damaged, or otherwise unsuitable fertilizer

will not be accepted.

B. Fertilizer shall be standard commercial fertilizers containing 12%, nitrogen, 8% phosphoric acid, and 8% potassium.

C. The fertilizers shall meet the specified requirements of the applicable State and Federal laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon.

2.5 MULCH

A. Mulch shall be virgin wood cellulose fibers from whole wood chips having a minimum of 20 percent fibers 0.42 inches (10.7mm) in length and 0.01 inches (0.27 mm) in diameter.

B. Mulch shall be dyed green for coverage verification purposes. Straw mulch or hydromulch may be used in lieu of wood mulch if accepted by the Engineer.

C. The Contractor shall demonstrate comparable performance of straw mulch or hydromulch to wood mulch for acceptance.

PART 3 - EXECUTION

3.1 PREPARATION OF AREA

A. Before applying fertilizer, areas to be seeded shall be rolled or otherwise cleared of stones larger than 2 inches in any diameter, sticks and other debris which might interfere with sowing of seed, growth of grass or subsequent maintenance of grass covered areas.

3.2 PLACING TOPSOIL

A. Topsoil shall be spread evenly on the prepared area to a uniform depth of 4-inches, after compaction.

B. Spreading shall not be done when the ground or topsoil is excessively wet or otherwise in a condition detrimental to the Work.

C. Spreading shall be carried on so that sodding operations can proceed with a minimum of soil preparation or tilling. After spreading, any large stiff clods and hard lumps shall be broken with a pulverizer or by other effective means and all

stones or rocks (2-inches or more in diameter), roots litter, or any foreign material shall be raked up and disposed of by the Contractor.

D. The topsoil surface shall conform to the required lines, grades and cross sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.

3.3 DISPOSAL OF WASTE MATERIALS

A. The Contractor shall legally dispose of all waste materials, (i.e. roots, stumps, brush, stones, clay lumps, etc.) generated during the processing of the on-site topsoil.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per square yard of topsoil at 4-inch minimum depth completed with seed, fertilizer, mulch, and watering as agreed upon by the Owner and the Contractor.

4.2 PAYMENT: Payment shall be made for all labor, materials, and equipment necessary for preparing and spreading topsoil, fertilizer, seeding, and mulch in square yard at 4-inch minimum depth as specified in the Drawings and specified herein. This shall include, but not necessarily be limited to: spreading topsoil, seeding, mulching, fertilizing, watering, and any other work incidental and included within this Section.

END OF SECTION

SECTION 01720
REMOVE AND REPLACE EXISTING GRAVEL/CHIP SEAL DRIVEWAY

PART 1 – GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, and equipment for the reconstruction of existing gravel and chip seal driveways.

B. Where references are made to other standards or codes, unless specified date references are indicated, the latest edition of said standard or code shall govern.

1.2 SUBMITTALS

A. The Contractor shall submit certification stating that type of Asphaltic Cement and Aggregates conform to this Section's requirements.

PART 2 – MATERIALS

2.1 ASPHALTIC CEMENT

A. TxDOT Item 300, "Asphalts, Oils, and Emulsions"

2.2 AGGRETATES

A. TxDOT Item 302, "Aggregates for Surface Treatments."

PART 3 - EXECUTION

3.1 REMOVAL OF EXISTING DRIVEWAY

A. If an existing driveway is to be removed and replaced, remove the existing driveway pavement to the depths and limits shown on the plans or identified by the Engineer using the methods described herein. Asphaltic concrete driveway pavements shall be cut with a concrete saw or other equipment approved by the Engineer. Existing gravel driveways shall be removed with appropriate excavation equipment as shown on the plans or approved by the Engineer. If necessary, remove adjacent soil and vegetation to prevent contamination of the driveway area, and place it in a windrow or stockpile. Do not damage adjacent pavement structure during removal and reconstruction operations.

3.2 PREPARING SUBGRADE

A. Compaction. Use approved equipment to compact the subgrade layer. The plans or the Engineer may require specific equipment. Compact until there is no evidence of further consolidation. Maintain a level layer to ensure uniform compaction. If the required stability or finish is lost for any reason, recompact and refinish the subgrade at no additional expense to the Owner. Backfill shall be placed in a

maximum of 8” thickness compacted to match existing density.

3.3 SURFACING

A. Gravel Driveway. A gravel driveway is defined as a driveway consisting entirely of flexible base material without an asphaltic concrete, Portland cement concrete, or surface treatment layer. The surface of the compacted base shall be smooth and in conformity with typical sections and to the established lines and grades.

B. Chip Seal Driveway. A chip seal driveway is a driveway with a surface treatment layer.

1. Weather

a) Standard Temperature Limitations. Apply surface treatment when air temperature is above 50ºF and rising. Do not apply surface treatment when air temperature is 60ºF and falling. In all cases, do not apply surface treatment when surface temperature is below 60ºF.

b) Polymer-Modified Asphalt Cement Temperature Limitations. When using materials described in TxDOT Item 300, Section 2.B, “Polymer Modified Asphalt Cement,” apply surface treatment when air temperature is above 70ºF and rising. Do not apply surface treatment when air temperature is 80ºF and falling. In all cases, do not apply surface treatment when surface temperature is below 70ºF.

c) Asphalt Material Designed for Winter Use. When winter asphalt application is allowed, the Engineer will approve the air and surface temperature for asphalt material application. Apply surface treatment at air and surface temperatures as directed.

2. Surface Preparation. Remove dirt, dust, or other harmful material before sealing.

3. Asphalt Placement. Select an application temperature, as approved, in accordance with TxDOT Item 300, “Asphalts, Oils, and Emulsions.” Uniformly apply the asphalt material at the rate of 0.2 Gallons per Square Yard, within 15ºF of the approved temperature, and not above the maximum allowable temperature.

4. Aggregate Placement. As soon as possible, apply aggregate uniformly at the rate directed without causing the rock to roll over.

5. Rolling. Start rolling operation on each shot as soon as aggregate is applied. Use sufficient rollers to cover the entire mat width in 1 pass, i.e., 1 direction. Unless otherwise shown on the plans, make a minimum of 5 passes.

6. Brooming. After rolling, sweep as soon as aggregate has sufficiently bonded to remove excess.

3.4 DISPOSAL OF WASTE MATERIALS

A. The Contractor shall legally dispose of all waste materials, generated during the processing of the on-site topsoil.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per square yard of removal and replacement of existing gravel or chip seal driveway as agreed upon by the Owner and the Contractor.

4.2 PAYMENT: Payment shall be made for all labor, materials, and equipment necessary for “Remove/Replace Existing Gravel/Chip Seal Driveway” in the unit price bid of square yard at 2-inch minimum depth as specified in the Drawings and specified herein. This shall include, but not necessarily be limited to: removal of existing driveway, preparing the subgrade, for furnishing and placing all materials, manipulations, labor, tools, equipment, and any other work incidental and included within this Section.

END OF SECTION

SECTION 01800
CHAIN LINK FENCE

PART 1 – GENERAL

1.1 SCOPE

A. The work included within this section consists of furnishing all material, equipment, and labor while performing all operations necessary for installing, removing, or replacing chain link fencing shown within the drawings and specified herein.

1.2 RELATED SECTIONS

A. Section 01100, Site Preparation

B. Section 01500, Concrete for Structures

C. Section 01510, Concrete Admixtures

1.3 REFERENCES

A. ASTM A121 Specification for Metallic-Coated Carbon Steel Barbed Wire

B. ASTM A392 Specification for Zinc-Coated Steel Chain-Link Fence Fabric

C. ASTM A491 Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric

D. ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

E. ASTM F552 Standard Terminology Relating to Chain Link Fencing

F. ASTM F567 Standard Practice for Installation of Chain Link Fence

G. ASTM F626 Specification for Fence Fittings

H. ASTM F900 Specification for Industrial and Commercial Swing Gates

I. ASTM F1043 Specification for Strength and Protective Coatings of Steel Industrial Chain Link Fence Framework

J. ASTM F1083 Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

PART 2 – PRODUCTS

2.1 WIRE FABRIC

A. Provide wire fabric with:

1. 9-gauge (0.148 in. diameter) steel wire with a minimum breaking strength of 1,290 lb. meeting ASTM A392 Class I or ASTM A491;

2. a mesh size of 2 in. ±1/8 in. between parallel wires with at least 7 meshes

in a vertical dimension of 23 in. along the diagonals of the openings;

3. knuckled selvages at the top and bottom edge of the fabric, unless otherwise shown on the plans.

2.2 POSTS

A. Provide posts of the size and weight shown on the plans. Do not provide rerolled or open-seam posts. Use material for all posts meeting ASTM F1043 Group 1A Regular Grade or Group 1C High Strength.

2.3 POST CAPS

A. Provide malleable iron post caps designed to exclude all moisture. Furnish barbed wire support arms integral with the post caps if barbed wire is shown on the plans. Furnish post caps with an opening for the top rail if top rail is shown on the plans. Post caps must have a 2-in. skirt.

2.4 GATES

A. Corner and tee fittings of malleable iron or pressed steel with means for attaching diagonal bracing members;

B. Hinges of malleable iron allowing a full 180° swing, easily operated by one person;

C. Ball-and-socket-type bottom hinges that do not twist or turn from the action of the gate and prevent the closed gate from being lifted off the hinges;

D. Positive stop that prevents any portion of the gate from swinging over an adjacent traffic lane;

E. Diagonal braces consisting of 3/8-in. diameter cable with turnbuckles, 2 to each gate frame, and, for vehicle gates, a vertical pipe brace of the size and weight shown on the plans at the center of each gate leaf;

F. Latches of malleable iron or steel for single gates with a single-fork latch and padlock eye that will keep the gate closed;

G. Two fork latches mounted on a center plunger rod with a padlock eye for double-leaf gates;

H. A malleable iron center rest, designed to receive the plunger rod anchored as shown on the plans for all double-leaf gates.

2.5 TOP RAIL

A. Use material meeting ASTM F1043 Group 1A or 1C for all top rail pipes. Provide 1.660 in. OD top rail manufactured from Group 1A standard weight (Schedule 40) steel pipe weighing 2.27 lb. per foot or from Group 1C high-strength pipe weighing 1.84 lb. per foot when shown on the plans. Provide pipe in sections at least 18 ft. long joined with outside steel sleeve couplings at least 6 in. long with a minimum wall thickness of 0.70 in. Use couplings designed to allow for expansion of the top rail.

2.6 TENSION WIRE

A. Use 7-gauge (0.177-in.) carbon steel wire with a minimum breaking strength of 1,950 lb. for the bottom edge of all fence fabric.

2.7 TRUSS BRACING

A. Provide truss bracing as shown on the plans.

2.8 CABLES

A. Provide 7-wire strand cables manufactured of galvanized annealed steel at lease 3/8 inch in diameter.

2.9 BARBED WIRE AND SUPPORT ARMS

A. Provide 3 strands of twisted 12.5-gauge barbed wire with 2-point, 14-gauge barbs spaced approximately 5 in. apart conforming to ASTM A121.

B. Provide support arms at an angle of 45° from vertical, with clips for attaching 3 strands of barbed wire to each support arm and sufficient strength to support a 200-lb. weight applied at the outer strand when barbed wire is specified on the plans.

2.10 STRETCHER BARS

A. Provide stretcher bars made of flat steel at least 3/16 × 3/4 in. and not more than 2 in. shorter than the fabric height. Provide one stretcher bar for each gate and end post and 2 stretcher bars for each corner and pull post.

2.11 GROUNDS

A. Provide copper-clad steel rods 8 ft. long with a minimum diameter of 5/8 in., or other UL-listed ground rods.

2.12 MISCELLANEOUS FITTINGS AND FASTENERS

A. Furnish enough fittings and fasteners to erect all fencing materials in a proper manner. Furnish fittings for posts from pressed or rolled steel, forged steel, malleable iron or wrought iron of good commercial quality spaced as shown on the plans.

2.13 COATINGS

A. Hot-dip galvanize all materials unless specified otherwise in this Item or on the plans. Fabric, tension wire, and barbed wire may be aluminum-coated or alloy-coated if approved. Additionally, coat all material except bolts, nuts, washers, and pipe material with thermally fused polyvinyl chloride (PVC) in accordance with ASTM F668, Class 2b, meeting the specified color when shown on the plans.

B. Aluminum Coating: Aluminum-coat in accordance with ASTM A491.

C. Alloy Coating: Coat with zinc-5% aluminum-mischmetal alloy (Zn-5A1-MM) in accordance with ASTM F1345, Class I.

D. Standard Weight (Schedule 40) Pipe: Hot-dip galvanize inside and outside according to ASTM F1043 (1.8 oz/ sq. ft. galvanized zinc weight)

E. High Strength Pipe: Hot-dip galvanize before or after forming pipe according to ASTM F1043 Group 1C and as follows:

1. Outside—minimum 0.9 oz./sq. ft. galvanized zinc weight with a verifiable polymer overcoat.

2. Inside—minimum 0.9 oz./sq. ft. galvanized zinc weight before forming, or minimum 0.3 mils zinc-based coating after forming containing a minimum 90% zinc dust, by weight.

F. Optional Additional Coating: Additionally coat all pipe material with 10 mils minimum thermally fused PVC according to ASTM F1043, meeting the specified color when shown on the plans.

G. Fittings, Bolts, and Other Miscellaneous Hardware: Galvanize all fittings, bolts, and miscellaneous hardware in conformance with Item 445, “Galvanizing.”

H. Tension Wire: Zinc-coat tension wire with a minimum coating of 0.80 oz./sq. ft. or aluminum-coat with a minimum coating of 0.30 oz./sq. ft.

I. Barbed Wire: Zinc-coat barbed wire in accordance with ASTM A121 (0.80 oz./sq. ft.) or aluminum-coat in accordance with ASTM A585 (0.30 oz./sq. ft.).

J. Pull Cable. Zinc-coat pull cable with a minimum coating of 0.80 oz./sq. ft. of individual-wire surface when tested in conformance with ASTM A116.

PART 3 – EXECUTION

3.1 CLEARING FENCE LINE

A. Clear all brush, rocks, and debris necessary for the installation of this fencing.

B. Stake the locations for corner posts and terminal posts unless otherwise shown on the plans. Follow the finished ground elevations for fencing panels between corner and terminal posts. Level off minor irregularities in the path of the fencing.

3.2 ERECTION OF POSTS

A. Install posts as shown on the plans. Plumb and permanently position posts with anchorages firmly set before fabric is placed. Brace corner and pull posts as shown on the plans.

3.3 POST SPACING

A. Space posts as shown in Table 1.

Table 1 Required Spacing by Post Type

Post Type	Required Spacing or Placement
Line Posts	No more than 10 feet apart
Pull Posts	No more than 500 feet apart and at each change in direction exceeding 20° vertically
Corner Posts	At each horizontal angle point

3.4 CABLES

A. Install cables on all terminal posts and extend to adjacent posts. Install cables on each side of corner and pull posts with a 3/8-inch drop-forged eye-and-eye or eye-and-clevis turnbuckle unless otherwise shown on the plans.

3.5 POST HOLES

A. Drill holes for concrete footings for all posts to provide footings of the dimensions shown on the plans.

B. Penetrate solid rock by at least 12 in. (18 in. for end, corner, gate, and pull posts) or to plan depth where the rock is encountered before reaching plan depth. Drill holes in the solid rock with a diameter at least 1 in. greater than the outside diameter of the post.

C. Fill the hole in the solid rock with grout consisting of 1-part hydraulic cement and 3-parts clean, well-graded sand after the posts are set and plumbed. If desired, other grouting materials may be used only if approved. Thoroughly work the grout into the hole, leaving no voids. Construct concrete footings from the solid rock to the top of the ground.

3.6 GATE AND GATE POST INSTALLATION

A. Align the tops of all gate frames with the fencing top tension wire or top rail. Provide vehicular gates that are greater in overall height than the adjacent fencing by the height necessary to extend to within 2 in. of the pavement between the curbs if curbs are shown on the plans.

B. Installation of swing gates shall be in compliance with ASTM 567.

C. Hinge and latch offset opening space shall be no greater than 3 inches in the closed position.

3.7 CONCRETE FOOTINGS

A. Center posts in their footings. Place concrete and compact by tamping or other approved methods. Machine mix all batches of concrete over 1/2 cu. yd. Hand mixing concrete is allowed on batches under 1/2 cu. yd.

B. Use forms for footings where the ground cannot be satisfactorily excavated to neat lines. Crown the concrete or grout (for solid rock) to carry water from the

post. Keep the forms in place for at least 24 hr. Backfill the footing with moistened material as soon as each form is removed, and thoroughly tamp. Cover concrete with at least 4 in. of loose moist material, free of clods and gravel, immediately after placing concrete. No other curing is required.

C. Spread all excess excavated and loose material used for curing neatly and uniformly. Remove excess concrete and other construction debris from the site.

3.8 ERECTION OF FABRIC

A. Place the fabric with the cables drawn taut with the turnbuckles after all posts have been permanently positioned and anchorages firmly set. Secure one end and apply enough tension to the other end to remove all slack before making attachments. Cut the fabric and independently attach each span at all corner posts and pull posts unless otherwise shown on the plans.

B. Follow the finished contour of the site with the bottom edge of fabric located approximately 2 in. above the grade. Grade uneven areas so the maximum distance between the bottom of fabric and ground is 6 in. or less.

C. Fasten fabric at 12 in. intervals to the top and bottom tension wires between posts. Fasten the fabric in the same manner when top rail is shown on the plans. Fasten the fabric on gate frames to the top and bottom of the frame at 12 in. intervals. Use steel wire fabric ties of 9-gauge steel or larger. Fasten fabric to terminal posts by steel stretcher bars and stretcher bar bands fitted with carriage bolts and nuts of the size and spacing shown on the plans. Use stretcher bars to fasten end posts, pull posts, corner posts, and gateposts with stretcher bar bands at intervals of no more than 15 in. Attach stretcher bars to terminal posts with 1 × 1/8 in. flat steel bands with 3/8-in. carriage bolts at intervals up to 15 in.

3.9 NUTS AND BOLTS

A. All bolts shall be installed with the head on the secure side of the fence. All bolts shall be peened over to prevent removal of the nuts.

3.10 ELECTRICAL GROUNDS

A. Provide one electrical ground at either side of each gate opening and at each corner post or end post. Grounds shall be located at every 1,000 feet of fence, at a minimum. Provide additional grounds directly under the point where power lines pass over the fence.

B. Vertically drive or drill in the grounding rod until the top of the rod is approximately 6 inches below the top of the ground. Connect a No. 6 solid copper conductor to the rod and to the fence by a UL-listed method so that each element of the fence is grounded.

C. Grounding shall be installed by a licensed electrical contractor.

3.11 CLEAN UP

A. The area of the fence line shall be left neat and free of any debris caused by the installation of the fence.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Chain link fence shall be measured by the linear foot of fence installed or removed, measured at the bottom of the fabric along the centerline of the fence from center to center of posts, excluding gates. Gates will be measured as each gate installed or removed.

4.2 PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Chain Link Fence (Install)" of the height specified or "Chain Link Fence (Remove)" and "Gate (Install)" of the type, height, and width of opening specified or "Gate (Remove)." Clearing and grading for fencing and gates will not be paid for directly but is subsidiary to this Item.

END OF SECTION

SECTION 02300
DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 SCOPE

A. This item shall govern the furnishing and installation of product piping (and casing where applicable) by the method of directional boring, sometimes referred to as horizontal directional drilling (HDD).

B. The Contractor shall provide all necessary tools, materials, and equipment to successfully complete the installation of directionally drilled piping as specified herein and shown on the drawings. The Contractor shall be responsible for the final constructed product and for furnishing the qualified labor and supervision necessary for this method of construction.

C. The Contractor shall furnish all items necessary to perform the horizontal directional drilling operation and construct the pipe to the lines and grade shown on the drawings.

1.1 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO).

B. Occupational Safety and Health Administration (OSHA).

1.2 SUBMITTALS

A. The Engineer and Owner will base the review of submitted details and data on the requirements of the completed work, safety of the work in regard to the public, potential for damage to public or private utilities and other existing structures and facilities, and the potential for unnecessary delay in the execution of the work. Such review shall not be construed to relieve the Contractor in any way of his responsibilities under the contract. Contractor shall not commence work on any items requiring Contractor's construction drawings or other submittals until the drawings and submittals are reviewed and accepted by the Engineer and Owner.

1. The Contractor shall submit for review complete construction drawings and/or complete written description identifying details of the proposed method of construction, a drill plan, and the sequence of operations to be performed during construction as required by the method of HDD excavation approved. The drawings and descriptions shall be sufficiently detailed to demonstrate to the Owner and Engineer whether the proposed materials and procedures will meet the requirements of this specification. Contractor shall submit arrangement drawings and technical specifications of the machine and trailing equipment (including any modifications), three-year experience record with this type of machine, and a copy of the manufacturer's operations manual for the machine.

2. Contractor's construction drawings shall be submitted on the following

items.

a. Complete details of the equipment to be utilized as well as the methods and procedures to be used, including but not limited to primary lining installation, timing of installation in relation to the excavation plan and sequence, bulkheads, etc.

b. Fluid pumping techniques including equipment, pumping procedures, pressure grout types, mixtures, and plug systems.

c. Method of controlling line and grade of excavation.

d. Details of cuttings & drilling fluid removal including equipment type, number, and disposal location. The composition of all drilling fluids proposed shall be submitted for approval. No fluid will be approved or utilized that does not comply with permit requirements and all applicable national, state, and local environmental regulations.

e. Proposed contingency plans for critical phases and areas of directional drilling.

B. Quality Control Methods. At least two (2) weeks prior to the start of directional drilling, Contractor shall submit a description of his quality control methods he proposes to use in his operations to the Engineer and Owner for review and approval. The submittal shall describe:

1. Procedures for controlling and checking line and grade.

2. Field forms for establishing and checking line and grade.

C. Safety. Procedures including, but not limited to, monitoring for gases encountered shall be submitted.

D. Hazardous chemical list as well as all MSDS and technical data sheets.

1.3 DESIGN CRITERIA

A. Compatibility of Methods.

1.4 The methods of excavation, lining, and groundwater control shall be compatible job conditions:

A. Environmental Protection

1. Take all necessary measures to eliminate the discharge of water, drilling mud, and cuttings to nearby waterways during the HDD work. If applicable, provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste.

B. Safety Requirements

1. Perform work in a manner to maximize safety and reduce exposure of personnel and equipment to hazardous and potentially hazardous conditions, in accordance with applicable safety standards.

2. Whenever there is an emergency or stoppage of work which is likely to endanger the excavation or adjacent structures, operate a full work

force for 24 hours a day, including weekends and holidays, without intermission until the emergency or hazardous conditions no longer jeopardize the stability and safety of the work.

C. Air Quality

Conduct directional drilling operations by methods and with equipment which will positively control dust, fumes, vapors, gases, or other atmospheric impurities in accordance with applicable safety requirements.

1.5 PERMITS

Obtain any and all other permits required for prosecution of the work.

PART 2 – PRODUCTS

2.1 GENERAL

A. The product pipe must comply with all applicable ASTM standards depending on the purpose and material of the product pipe. Join the pipe sections so that the joining pipe sections are installable using HDD. Ensure that the joined product pipes have adequate strength and flexibility to withstand the installation stresses, overburden pressures, and operating pressures without compromising the structural stability of the pipe wall. Ensure that the product pipe meets the bend radius required for the proposed installation.

B. The following material standards are the minimum in place standards for the product pipe:

Material Standards for HDD Installation		
Material Type	Non-Pressure	Pressure
Polyethylene (PE)	ASTM D 2447	ASTM 2513 ASTM D 2447
High Density Polyethylene (HDPE)	ASTM D 2447 ASTM D 3350 ASTM F 714	ASTM D 2447 ASTM D 3350 ASTM F 714 ASTM 2513
Polyvinyl-Chloride (PVC)	ASTM F 789	ASTM D1785 ASTM D2241
Steel	ASTM A129 Grade B	AWWA C200 API 2B

C. Detection Wire: Electronic detection material for non-conductive piping products. Select tracer wire design for HDD to conductively locate underground utility lines according to ASTM D-1248. Use either a continuous green sheathed solid conductor copper wire line (minimum #12 AWG for external placement) or a coated conductive tape. Select a minimum 12-gauge copper clad steel wire that is able to withstand the installation tension along the entire length of the line.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for his means and methods of directional drilling construction and shall ensure the safety of the work, the Contractor's employees, the public, and the adjacent property, whether public or private.

B. Contractor should anticipate that portions of the drilled excavation could be below the groundwater table and/or under waterways.

C. Comply with all local, state, and federal laws as well as rules and regulations at all times to prevent pollution of the air, ground, and water.

3.2 EQUIPMENT

A. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback of the pipe, a drilling fluid mixing and delivery system of sufficient capacity to successfully complete the installation, a guidance system to accurately guide boring operations, and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in good working order for the duration of this project.

B. Diesel, electrical, or air-powered equipment will be acceptable and is subject to applicable federal and state regulations.

C. Any method or equipment that the Contractor can demonstrate will produce the specified results will be considered.

D. Contractor shall employ equipment that will be capable of handling the various anticipated ground conditions. In addition, the equipment shall:

1. Be capable of minimizing loss of ground ahead of and around the machine and providing satisfactory support of the excavated face at all times.

2. Provide a system to indicate whether the amount of earth material removed is equivalent to that displaced by the advance of the machine such that the advance rate may be controlled accordingly.

E. Provide adequate secondary containment for any and all portable storage tanks.

D. Drilling must be accomplished with fluid-assisted mechanical cutting. Design/select drilling fluid to transport the spoils, maintain temperature of bits and transmitter, clean cutting from drill bit, reduce friction and pullback on drill rod and product pipe, stabilize the borehole, and reduce migration of drilling fluids in soil. Drilling fluids shall be a mixture of potable water and bentonite (or other stabilizing agent polymers and additives). It is mandatory that minimum pressures and flow rates be used during drilling operation as to avoid fracturing the sub-grade material around and above the bore.

E. The mobile drilling system must be capable of being launched from the surface at an inclined angle and drilling a sufficient diameter pilot hole. The pilot hole will then be enlarged with reamers as required to achieve the completed directional drill bore hole diameter.

3.3 DIRECTIONAL DRILLING DATA

A. Daily logs of construction events and observations shall be submitted on at least the following:

1. Location and elevation of significant soil strata boundaries and brief soil descriptions.

2. Jacking pressures and torsional forces, if applicable.

B. The path of the pilot hole shall be monitored during drilling by taking downhole survey readings at intervals not to exceed 35 feet. These readings shall be used to calculate the horizontal and vertical coordinates of the downhole probe as it progresses along the pilot hole. Calculations shall be performed according to API Bulletin D20. Recorded data and calculations from downhole surveys shall include, but not be limited to the following items:

1. Course length. The distance between two downhole surveys as measured along the drilled path.

2. Measured distance. The total distance of a downhole survey from the entry points as measured along the drilled path; also the summation of the course lengths.

3. Inclination. The angle at which the downhole probe is projecting from the vertical axis at a particular downhole survey point; vertically downward corresponds to zero degrees.

4. Azimuth. The angle at which the downhole probe is projecting in the horizontal plane at a particular downhole survey point; magnetic north corresponds to zero degrees.

5. Station. The horizontal position of a downhole survey measured from an established horizontal control system.

6. Elevation. The vertical position of a downhole survey measured from an established vertical control system.

7. Right. The distance of a downhole survey from the design path reference line; positive values indicate right of the reference line while negative values indicate left of the reference line.

3.4 CONTROL OF THE DRILL LINE AND GRADE

A. Construction Control

1. The Contractor shall establish and be fully responsible for the accuracy of his own control for the construction of the entire project, including structures, drill line, and grade.

2. The Contractor’s control points shall be established sufficiently far from the drilling operation not to be affected by construction operations.

3. The Contractor shall maintain daily records of alignment and grade and shall submit three copies of these records to the Owner and Engineer. However, the Contractor remains fully responsible for the accuracy of his work and the correction of it, as required.

4. The Contractor shall check his control for the bore alignment against an

above ground undisturbed reference at least once for each rod length of bore constructed or more often as needed or directed by the Owner and Engineer. Contractor shall furnish a "Directional Bore Log" for each bore completed.

3.5 DISPOSAL OF EXCESS MATERIAL

A. Where such effort is necessary, cost for groundwater control during the course of the drilling work shall be included in the unit contract price for the work.

B. Dewatering required during the course of the project to lower water table, to remove standing water, surface drainage seepage, or to protect ongoing work against rising waters or floods shall be considered incidental to the work being performed.

C. Contractor shall remove all puddled bentonite (drillers mud) and dispose of off-site in a legal manner, at no additional cost to the Owner.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot for each diameter and type of HDD pipe installed and as accepted by the Owner.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for drilling and installing various diameter and type of HDD pipe per linear foot. Includes removal of excavated materials and spoils, removal and disposal of drilling fluids, backfilling, and complete restoration of the site according to the unit prices submitted in the bid. No payment will be made for failed bore paths, injection of flowable fill, products taken out of service or incomplete installations due to fault of the Contractor.

A. No payment will be made for the HDD work until the daily construction logs and records of alignment have been delivered to and reviewed by the Engineer.

END OF SECTION

SECTION 02400
VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 SCOPE

A. The work included in this Section consists of furnishing all labor, materials, equipment and incidentals required to install complete and ready for operation and testing all valves and appurtenances as shown within the Construction Drawings and as specified herein.

B. The work includes, but is not necessarily limited to, all types of valves required for buried, exposed, submerged, and other types of piping, except where otherwise specifically included in other Sections.

C. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 DESCRIPTIONS OF REQUIREMENTS

A. The Contractor shall furnish and install the gate valves in accordance with the Typical Iron Valve Box Standard Detail as per the drawings.

B. The Contractor shall furnish and install flush valves in accordance with the Flush Valve Detail as per the drawings.

C. The Contractor shall install valve markers in accordance with the Marker Standard Detail drawing as per the drawings.

1.3 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer shall have a minimum of five (5) years of experience in the production of substantially similar equipment and shall show evidence of satisfactory service in at least five (5) installations.

2. All units of the same type shall be the product of one manufacturer.

3. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.4 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01350, Hydrotesting and Disinfection

C. Section 02650, PVC for Water Mains

D. Section 02660, Ductile-Iron Pipe

E. Section 02665, HDPE Pipe

F. Section 02680, Joint Restraints and Thrust Blocking

1.5 REFERENCE STANDARDS

A. Comply with the following applicable provisions and recommendations, except as otherwise shown or specified where reference is made to one of the below referenced standards, the revision in effect at the time of bid opening shall apply.

1. ASTM A48 - Specification for Gray Iron Castings
2. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 psi Tensile Strength
4. ASTM A436 - Specification for Austenitic Gray Iron Castings
5. ASTM A536 - Specification for Ductile Iron Castings
6. AWWA C500 – Metal-Seated Gate Valves for Water Supply Service
7. AWWA C504 – Rubber-Seated Butterfly Valves
8. AWWA C507 – Ball Valves, 6-inch through 48-inch
9. AWWA C508 – Swing-Check Valves for Waterwork Service, 2-inch through 24-inch NPS
10. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service
11. AWWA C518 - Double-Disc Swing- Check Valves for Waterworks Service, 2-inch through 48-inch NPS
12. AWWA C520 - Knife Gate Valves, Sizes 2 In. Through 96 In.
13. AWWA C540 – Power Actuating Devices for Valves and Sluice Gates
14. AWWA C541 – Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates
15. AWWA C542 – Electric Motor Actuators for Valves and Slide Gates
16. AWWA C550 - Protective Interior Coatings for Valves and Hydrants
17. MSS-SP-67 – Butterfly Valves
18. MSS-SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends
19. MSS-SP-82 - Valve Pressure Testing Methods
20. MSS-SP-98 - Protective Coatings for Interior of Valves and Hydrants
21. Valves shall be NSF-61 certified.
22. AGMA Standards
23. NEMA, National Electrical Manufacturer’s Association.

1.6 SUBMITTALS

A. Shop Drawings

1. Manufacturer's literature, illustrations, paint certifications, specifications, detailed drawings, data and descriptive literature on all valves and

appurtenances.

2. Proposed deviations from the contract documents.

3. Engineering data including dimensions, materials, sizes and weights.

4. Fabrication, assembly, installation and wiring diagrams.

5. Additional submittal data, where noted, with individual pieces of equipment.

B. Test Reports

1. Provide certified hydrostatic test data, per Manufacturer's standard procedure or MSS-SP-61 for valve.

2. Hydrostatic tests shall be performed, when required by the valve specifications included herein.

C. Certificates

1. For each valve specified to be manufactured, tested and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests and certification of proper installation.

D. Operating and Maintenance Data

1. Operating and maintenance instructions shall be furnished to the Owner. The instructions shall be prepared specifically for the project installation and shall include all required cuts, drawings, equipment lists, descriptions, and other information required to instruct operating and maintenance personnel that may be unfamiliar with such equipment.

2. Provide copies of all shop drawings, test reports, maintenance data and schedules, description of operation; and spare parts information.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping

1. Care shall be taken in loading, transporting and unloading to prevent damage to the valves, appurtenances, or coatings. Equipment shall not be dropped. All valves and appurtenances shall be examined before installation and no piece shall be installed which is found to be defective. Any damage to the coatings shall be repaired by the Contractor as acceptable to the Owner.

2. Prior to shipping, the ends of all valves shall be acceptably covered to prevent entry of foreign material. Covers shall remain in place until just before installation and connecting piping is completed.

B. Storage and Protection

1. Special care shall be taken to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, to prevent deformation. See the individual valve specifications and manufacturer's information for further requirements.

C. Delivery

1. Deliver material to the site to ensure uninterrupted progress of the work.

a. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to not delay Work.

1.8 MAINTENANCE

A. Special tools and the manufacturer's standard spare parts if required for normal operation and maintenance, shall be supplied with the equipment in accordance with the contract documents and where notes, as specified herein.

B. Provide all special tools required for normal maintenance. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.

C. Provide the Owner a list of all spare and replacement parts with individual prices and locations where they are available.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Valves shall have manufacturer's name and working pressure cast in raised letters on valve body.

B. Manual valve operators shall turn clockwise to close, unless otherwise specified.

C. Unless otherwise specified, all flanged valves shall have ends conforming to ANSI B16.1, Class 125.

D. Buried valves shall be provided with adjustable two-piece valve boxes and provided with extension stems, operating nuts and covers unless otherwise shown or specified. Extension stems shall terminate 12-inches below furnished grade.

E. All bolts, nuts, and studs on or required to connect buried or submerged valves shall be Type 316 stainless steel.

F. All bolts and studs embedded in concrete and studs required for wall pipe shall be of Type 316 stainless steel.

G. All other bolts, nuts, and studs shall, unless otherwise approved, conform to ASTM A 307, Grade B; or ASTM A 354.

H. Bolts shall have hexagon heads and nuts.

I. Gasket material and installation shall conform to manufacturer's recommendations.

J. Identification: Identify each valve 4 inches and larger with a stainless-steel nameplate stamped with the approved designation. Nameplate shall be permanently fastened to valve body at the factory. Stenciled designations are acceptable for buried valves.

K. The Contractor shall be responsible for coordinating compatible materials of construction for all wettable parts of all valves for each process application.

L. The use of a manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

M. Valves shall be of the size shown on the Drawings or as noted; and equipment of the same type shall be identical and from one manufacturer.

N. Each valve box shall be fitted with a plastic valve ID tag (Blue Emedco 3 ½" x 2 ¾"). Tags shall be securely fastened to valves.

O. Valves and appurtenances shall be marked per AWWA Standards with the Owner name (CCSUD), valve size, flow directional arrows, year of manufacture, working pressure for which they are designed, and standard referenced, cast in raised letters or indelibly marked upon some appropriate part of the body.

P. Joints, size, and material - unless otherwise noted or required by the Owner:

1. Except where noted, all joints referred to herein shall be of the same type, nominal diameter, material, and with a minimum rating equal to the pipe or fittings to which they are connected.

2. Valves and appurtenances shall be of the same nominal diameter as the pipe or fittings they are connected to.

3. All valves exposed to view (above-grade), or in vaults (below-grade).

   a. 3-inches and smaller - threaded ends

   b. 4-inches and larger - flanged ends

Q. Provide all special adaptors as required to ensure compatibility between valves, appurtenances, and adjacent pipe.

R. Valves located outdoors but not within a building; within maximum 2-ft above liquid; in vaults; or where otherwise noted shall be especially designed for submerged service where water may completely submerge the valve. All other units shall be as a minimum weather tight.

S. Rising stem valves shall be sealed with adjustable and replaceable packing; valve design must permit packing replacement under operating system pressures with only moderate leakage.

T. Non-rising stem valves shall use a double O-ring stem seal, except that packing shall be used where geared operators are required.

U. Except as otherwise specified, valves shall be rated for the following working water pressures:

Valve Size	Pressure (psi)
3-inches to 12-inches	200
14-inches to 20-inches	150
24-inches and greater	150

2.2 GATE VALVES

A. Valves shall be resilient seated, non-rising stem with a ductile iron body and bonnet in conformance with AWWA C515 or cast-iron body and bonnet in conformance with AWWA C509.

B. Unless otherwise shown or specified, exposed valves shall have flanged ends conforming to ANSI B16.1, Class 125. Buried valves shall be provided with mechanical joint adapters.

C. The resilient wedge shall have tongue and groove guides for wedges.

D. Resilient wedge valves shall be coated, interior and exterior, with fusion bonded epoxy per AWWA C550.

E. Resilient wedge gate valves shall have no recesses in valve body.

F. Exposed manually operated gate valves shall be equipped with hand wheels. Gate valves located more than five feet above the operating floor shall be provided with chain wheels, sprockets, and aluminum chain. The chain shall extend to three feet above the operating floor.

G. Buried gate valves shall be furnished with valve boxes, nut operated extension stems and tee wrenches as required.

H. Product and Manufacturer: Provide gate valves of one of the following, as listed in the Approved Equipment List (AEL):

1. Mueller Water Products, Inc.
2. American Cast Iron Pipe Company.
3. EJ Group, Inc.
4. Clow Valve Company.
5. Or Approved Equivalent.

I. Exposed gate valves 16-inches and greater in size shall have valve by-pass.

J. All bonnet and packing gland bolts and nuts shall be made from a specified corrosion-resistant material such as low-zinc bronze, nickel-copper alloy or stainless steel or some other approved equivalent. Stainless steel bolts shall not be used on stainless steel nuts unless the threads are coated with an anti-seize compound or the fastening components are made of different alloys or some other means to prevent galling.

K. Exposed gate valves 16-inches and greater indicated for horizontal stem Installation shall be furnished with rollers, tracks and scrapers and enclosed bevel gear grease case.

L. Unless otherwise indicated, gate valves 12-inches and smaller shall be capable of installation in the vertical or horizontal position, sealing in both directions at the rated pressure.

2.3 KNIFE GATE VALVES

A. Valves shall be ductile iron construction, steel gate. Shall be designed, manufactured, and tested in accordance with AWWA C520.

B. Unless otherwise shown or specified, valves shall have flanged ends conforming to ANSI B16.5, Class 125.

C. Exposed manually operated knife gate valves shall be equipped with hand wheels. Gate valves located more than five feet above the operating floor shall be provided with chain wheels, sprockets, and aluminum chain. The chain shall extend to three feet above the operating floor.

D. Shop Painting:

1. Interior metal surfaces of cast iron valves shall be cleaned with a near white blast (SSPC-SP10) and shall be shop painted with two coats of an NSF 61 certified epoxy coating applied in accordance with the manufacturer's recommendations.

2. Exterior surfaces of the valves shall be shop painted as specified hereinafter under Paragraph 2.10 of this Section.

E. Product and Manufacturer: Provide knife gate valves of one of the following, as listed in the Approved Equipment List (AEL):

1. Wey Valve

2. Emerson

3. Dezurik

4. Or approved equivalent.

2.4 CHECK VALVES - LIQUID SERVICE

A. General

1. Check valves shall absolutely prevent the return of water back through the valve when the upstream pressure decreases below the downstream pressure. The valve shall be tight seating.

B. Double Disc Type

1. Valves shall be designed, manufactured, and tested in accordance with ANSI/AWWA C518.

2. Shall be provided with ANSI B16.1 Class 125 flanges for installation.

3. Shop Painting:

a. Exterior surfaces of the valve shall be shop painted as specified hereinafter under Paragraph 2.10 of this Section.

4. Product and Manufacturer: provide double disc type check valves of one of the following:

a. Valmatic 8800

b. Or Approved Equivalent.

C. Slanting Disc Type – Pump Discharge (Vertically Oriented)

1. The check valve shall be designed to operate in full open position with a velocity range of 3 to 10 feet per second.

2. Disc position indicator shall be provided.

3. 125 lb. class.

4. Shop Painting:

   a. Interior metal surfaces of the valve, except finished or bearing surfaces, shall be cleaned with a near white blast (SSPC-SP10) and shall be shop painted with two coats of an NSF 61 certified epoxy coating applied in accordance with the manufacturer's recommendations.

   b. Exterior surfaces of the valve shall be shop painted as specified hereinafter under Paragraph 2.10 of this Section.

5. Product and Manufacturer: Provide tilting disc, slow opening and controlled closing check valves of one of the following:

   a. APCO Series 800 T (APCO Willamette Valve & Primer Corp.).

   b. Or Approved Equivalent.

2.5 BUTTERFLY VALVES – WATER SERVICE

A. Valves shall be short body, except where otherwise shown or required to obtain required clearances for valve operator or disc. Valves shall conform to AWWA C504.

B. Valves shall be of the 125-psi pressure class.

C. Flanged ends, where required, shall conform to ANSI B16.1, Class 125.

D. Valve seats shall be mounted in cast-iron valve body, made of rubber suitable for water service.

E. Shafts, retaining rings and internal hardware shall be of stainless steel.

F. Shafts seals of non-buried valves shall have a stuffing box and pull-down packing gland. Packing shall be replaceable without removing the valve operator. Buried valves shall be furnished with self-adjusting "V" type packing.

G. Provide a stainless-steel seating edge on all discs.

H. Product and Manufacturer: Provide butterfly valves (Circular) of one of the following:

   1. Mueller Water Products, Inc.

   2. DeZurick/APCO/Hilton.

   3. Or Approved Equivalent.

I. Valve Operator – Manual:

   1. Valves shall be equipped with an enclosed worm gear drive and nut, hand wheel or chain wheel operator.

   2. Enclosed worm gear operators shall have a gear ratio designed not to exceed 80 pounds pull to meet the required operator torque.

   3. Gears shall be permanently lubricated and totally enclosed.

   4. Operators shall be designed to hold the valve disc in any intermediate position without creeping or fluttering.

5. Adjustable stops shall be provided to prevent over-travel in either position, to withstand a pull of 200 pounds.

6. Stops shall be enclosed within the operator housing and be capable of absorbing the full operator torque with a minimum safety factor of five (5).

7. Operators shall be equipped with a direct coupled indicator.

8. Valves regardless of size, if installed with the operating wheel more than five feet above the operating floor, shall be provided with a chain wheel, sprocket, and aluminum chain. The chain shall extend to three feet above the operating floor.

9. Valve operator shall be designed to fully close or fully open the valve in a maximum of 30 turns. Valves shall open counterclockwise and shall have a position indicator.

10. Shop Painting:

    a. Interior metal surfaces of the valve, except finished or bearing surfaces, shall be cleaned with a near white blast (SSPC-SP10) and shall be shop painted with two coats of an NSF 61 certified epoxy coating applied in accordance with the manufacturer's recommendations.

    b. Exterior surfaces of the valve shall be shop painted as specified hereinafter under Paragraph 2.10 of this Section.

11. Product and Manufacturer: Provide manual operators of one of the following:

    a. Flowserve Corporation.

    b. Or Approved Equivalent.

2.6 RUBBER SEAT BALL VALVES

A. Valves shall have a cast iron body suitable for 150 psi pressure. Body shall have stainless steel conical seating surfaces to provide abrasion-free, corrosion free surfaces for mating with the resilient seat on the rotor.

B. Ends shall be flanged, conforming to ANSI B16.1, Class 125.

C. Shaft seal shall be of bronze, provided with "O" ring seals.

D. Shaft bearings shall be of bronze, permanently lubricated, sealed with "O" ring seals.

E. Seats shall be of rubber suitable for water service, secured to the rotor by means of ductile Ni-Resist adjusting segments.

F. Rotor shall be of cast iron, secured to stub shafts with stainless steel taper pins.

G. Stub shafts shall be made of stainless steel.

H. Provide adjustable thrust bearings for alignment of the rotor in the body.

I. Manufacturer: Provide rubber seat valves of one of the following:

1. Mueller Water Products, Inc.

2. Or Approved Equivalent.

2.7 PINCH CHECK VALVES

A. Pinch Check Valves shall be all rubber, and of the flow operated check type with a slip-on end connection.

B. Valve shall be one-piece rubber construction with fabric reinforcement.

C. Valve shall have protective EDPM exterior wrapping for UV protection.

D. Provide stainless steel attachment straps and hardware as needed to securely attach valve to pipe.

E. Manufacturer: Provide rubber pinch check valve of one of the following:

1. Tideflex Technologies.
2. Or Approved Equivalent.

2.8 PINCH VALVES

A. Pipe Automatic Pinch Valves shall be cast iron construction.

B. connections shall be ANSI Class 125/150 flanged.

C. Sleeves shall be made of EDPM.

D. Provide stainless steel bolts and hardware as needed to securely attach the valve to the pipe.

E. Provide manufacturers standard protective exterior coating for outdoor service.

F. Manufacturer: Provide manual pinch valve of one of the following:

1. Red Valve Company, Inc.
2. Or Approved Equivalent.

2.9 SPECIALS

A. Corporation Stops:

1. Where shown or necessary to complete the work, corporation stops shall be furnished with bronze stem, washer, nut, body, and key.
2. Product Manufacturer: Provide Corporation Stops of one of the following:
   a. Ford Meter Corporation Stops: Box Company, Inc.
   b. Or Approved Equivalent.

B. Hose Bibbs:

1. House bibbs shall consist of a boiler drain type valve and vacuum breaker.
2. Valve shall be ¾-inch size or 1-inch size as shown on Drawings, bronze bodied, with aluminum hand wheel and renewable composition disc, suitable for 125 psi working pressure.
3. Valve shall have one male copper joint end and one male hose thread end.
4. Product and Manufacturer: Provide House Bibbs of one of the following:

a. NIBCO.

b. Jenkins.

c. Or Approved Equivalent.

2.10 VALVE APPURTENANCES

A. Operators:

1. General: The operators shall be sized based on the maximum expected torque as per valve manufacturer's recommendations and in no case shall the force required to open or close the valve (i.e., rim pull) exceed 40 pounds. The responsibility for proper operation shall reside with the valve supplier.

2. Manual Operators: Manual operators shall be in compliance with AWWA C504 and shall be of the worm gear type and feature a housing that encloses all gearing and can either be buried or is of weatherproof construction for exposed locations. The operator's housing shall be constructed of cast iron and shall be permanently grease packed. All housing O-rings, gaskets, and other features shall be designed to ensure permanent water tightness and maintenance free operation. The axis of the worm gear shaft shall remain fixed during operation and stop-limiting devices shall be provided to limit operator travel. Valves scheduled for above ground service shall be equipped with a hand wheel. Buried valves shall be equipped with a 2-inch square AWWA operating nut. Suitable manufacturers include Limitorque, E-I-M, DeZurick, or approved equivalent.

3. Chain Operators:

a. All valves more than 5 feet-0 inches above operating floor level shall be equipped with chain operator and sprocket wheel bolted directly to the valve operating wheel

b. Aluminum chain shall be provided. Equip all operators with a ½-inch hook bolt located to keep chain out of walking areas.

B. Extension Stems, Stem Guides, Wrenches and Keys:

1. Extension stem shall be at least as large as valve stem it operates.

2. Provide intermediate stem guide for extensions more than 7 feet long.

3. Stem brackets and guides shall be made of cast iron and have fully adjustable bronzed bushed guide block. Fasten brackets to walls with approved expansion bolts.

4. Operating nuts about 2 inches square shall be included with each extension stem and located in floor box or grating recess, as required.

5. Provide operating key or wrench of suitable length and size for each valve that is not readily accessible for direct operation.

C. Valve Boxes - Provide each buried valve with a valve box as follows:

1. Made of heavy pattern cast-iron, 2-piece adjustable telescoping type.

2. Lower section shall enclose operating nut and stuffing box and rest on

bonnet.

3. Inside diameter shall be at least 4 ½ inches.
4. Provide extension stem and operating nut.
5. Cover shall be heavy duty cast iron with direction to open arrow cast in.
6. Provide valve box of adequate size for operation and maintenance of buried valves where shown.
7. Square covers shall be provided for all recycled water main valve boxes. Round covers shall be provided for all potable water main valve boxes and labeled “WATER.”

2.11 SURFACE PREPARATION, SHOP PAINTING AND COATING

A. Notwithstanding any of these Specifications, all coatings, and lubricants in contact with potable water shall be certified as accepted for use with that fluid.

B. If manufacturer’s requirements are not to provide finished coating on any interior surfaces, then the Manufacturer shall so state and no interior finish coating will be required, if acceptable to the Owner.

C. Clean and prime coat all ferrous metal surfaces of each valve in the shop.

D. Coat all machined, polished and non-ferrous surfaces including gears, bearing surfaces and similar unpainted surfaces with a corrosion prevention compound which shall be maintained during storage and until equipment begins operation.

E. Coating

1. Interior coating shall comply with AWWA C550 and shall be certified to NSF 61.
2. Coating shall be a fusion bonded (thermosetting) epoxy protective coating and shall function as a physical, chemical and electrical barrier between the base metal to which it is applied and the surrounds.
3. The coating shall be nontoxic and shall not impart taste or odor to water.
4. Coating shall have a gloss finish and shall be suitable for field over-coating and touch-up without sanding or special surface preparation, or application of heat in excess of room temperature.
5. Corrosion resisting pigments. The coating includes a corrosion inhibiting ingredient to provide protective action as small nicks or scratches penetrate the base metal.
6. Standard coating is 10 mils nominal thickness.
7. The coating shall have a successful record of performance on gate valves for a minimum of five (5) years.

PART 3 – EXECUTION

3.1 INSTALLATION

A. All valves and appurtenances shall be installed per the Manufacturer's instructions in the locations shown, true to alignment and rigidly supported. Any damage to the

valves and appurtenances shall be repaired to the satisfaction of the Owner before they are installed.

B. Install all brackets, extension rods, guides, the various types of operators and appurtenances as shown on the drawings, or otherwise required. Before setting these items, the Contractor shall check all drawings and figures which have a direct bearing on their location. The Contractor shall be responsible for the proper location of valves and appurtenances during the construction of the Work.

C. All components shall be carefully inspected for defects in construction and materials. All debris and foreign material shall be cleaned out of openings, etc. All valve flange covers shall remain in place until connected piping is in place. All operating mechanisms shall be operated to check their proper functioning and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the Owner.

D. All items (including valve interiors) shall be cleaned prior to installation, testing, disinfection and final acceptance.

E. Unless otherwise noted, joints for valves and appurtenances shall be made up utilizing the same procedures as specified under the applicable type connecting pipe joint and all valves and other items shall be installed in the proper position as recommended by the Manufacturer. Contractor shall be responsible for verifying manufacturer's torquing requirements for all valves.

F. Install all valves so that operating wheels or wrenches may be conveniently turned from operating floor but without interfering with access, and as approved by the Engineer.

G. Unless otherwise approved, install all valves plumb and level. Install valves free from distortion and strain caused by misaligned piping, equipment or other causes.

H. Set valve boxed plumb and centered with the bodies directly over the valves. Carefully tamp earth fill around each valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face, if less than 4 feet.

3.2 INSTALLATION OF MANUAL OPERATIONAL DEVICES

A. Unless otherwise noted, all operational devices shall be installed with the units at the factory, as shown on the drawings or as acceptable to the Owner, to allow accessibility to operate and maintain the item and to prevent interference with other piping, valves and appurtenances.

B. For manually operated valves 3-inches in diameter and smaller, valve operators and indicators shall be rotated to display toward normal operation locations.

C. Floor boxes, valve boxes, and extension stems shall be installed vertically centered over the operating nut, with couplings as required and the elevation of the box top shall be adjusted to conform with the elevation of the finished floor surface or grade at the completion of the Contract. Boxes and stem guides shall be adequately supported during concrete pouring to maintain vertical alignment.

3.3 INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

A. Take care not to over pressure valves or appurtenances during pipe testing. If any

unit proves to be defective, it shall be replaced or repaired to the satisfaction of the Owner.

B. Functional Test: All items shall be inspected for proper alignment, operation, proper connection and satisfactory performance. All units shall be operated continuously while connected to the attached piping for at least 8 hours, without vibration, jamming, leakage, or overheating and perform the specified function.

C. The various pipelines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests, any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the Owner.

D. Various regulating valves, strainers, or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities and any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the Owner.

E. Gate Valves: Perform shop tests in accordance with AWWA C500, except no leakage shall occur with design pressure held for one minute.

F. Conduct functional field test of each valve in presence of Engineer to demonstrate that each part and all components function together correctly.

3.4 HYDROTESTING AND DISINFECTION

E. Hydrotesting and disinfection shall be in accordance with Section 01350 of these Project Specifications.

F. All valve bodies shall be hydrostatically tested to at least twice the rated working water pressure. In addition, valves shall be seat-tested, bi-directional at the rated working pressure, with seat leakage not to exceed one fluid ounce per inch of valve diameter per hour. Provide certificates of hydrostatic testing results to Engineer.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity that is measured, “per each,” for payment shall be the actual number of valves of each class, type, and size (including actuators, valve boxes, and marker posts/signs) that are furnished and installed by the Contractor for acceptance by the Owner.

4.2 PAYMENT: Payment shall include all labor, materials, testing, and equipment necessary for furnishing and installing complete functioning valves and valve boxes of various sizes as per the Drawings and as specified herein. This item shall also include, but not be limited to: all types and sizes of valves; valve stem; valve box and cover; valve box extensions; concrete collar around valve box; base material below the valve per the Drawings; valve marker, project staking; sheeting; gearing; painting; coating; nut operator extension; excavation and backfill; trenching; restraining utility poles; hydrotesting and disinfection; all items related to trench excavation safety; and all other work incidental to the installation of functional gate valve and box with marker sign complete in place and in reliable service.

END OF SECTION

SECTION 02440
COMBINATION AIR RELEASE VALVE

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, testing, equipment, and incidentals required to install a complete combination air release valve assembly.

B. The Contractor shall furnish and install combination air valve assemblies in accordance with the Air Release Valve Standard Detail as shown within the Drawings.

C. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 QUALITY ASSURANCE

A. Qualifications

1. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

2. Provide the services of a qualified and factory-trained service representative of the Manufacturer to provide operational and maintenance instructions.

1.3 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01350, Hydrotesting and Disinfection

1.4 REFERENCE STANDARDS

A. Comply with the following applicable provisions and recommendations, except as otherwise shown or specified where reference is made to one of the below listed standards, the revision in effect at the time of bid opening shall apply.

1. ASTM A48 Class 35 – Gray Iron Castings

2. ASTM A126 Class B – Gray Iron Castings for Valves, Flanges, and Pipe Fittings

3. ANSI/NSF Standard 60 – Drinking Water Treatment Chemicals

4. ANSI/NSF Standard 61 – Drinking Water System Components

1.5 SUBMITTALS

A. Shop Drawings

1. Manufacturer's literature, illustrations, paint certifications, specifications, detailed drawings, data and descriptive literature on combination air valves.

2. Engineering data including dimensions, materials, size, and weight.

3. Additional submittal data, where noted with individual pieces of equipment.

B. Certificates

1. The Manufacturer shall provide certification that products furnished under this specification are manufactured in an ISO 9001 certified facility or documentation from an accredited facility that ISO 9001 certification is in process.

C. Operating and Maintenance Data

1. Operating and maintenance instructions shall be furnished to the Owner. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions and other information required to instruct operating and maintenance personnel unfamiliar with such equipment.

2. Copies of all shop drawings, test reports, maintenance data and schedules, description of operation and spare parts information shall be provided to the Owner.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping

1. Care shall be taken in loading, transporting, and unloading to prevent injury to the valves, appurtenances, or coatings. Equipment shall not be dropped. Each combination air valve and assembly components shall be examined before installation and no piece shall be installed which is found to be defective. Any damage to the coatings shall be repaired as acceptable to the Owner.

2. Prior to shipping, the ends of all valves shall be acceptably covered to prevent entry of foreign material. Covers shall remain in place until after installation and connecting piping is completed.

B. Storage and Protection

1. Special care shall be taken to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, to prevent deformation. See the individual piping specifications and Manufacturer's information for further requirements.

1.7 MAINTENANCE

A. Special tools and the Manufacturer's standard spare parts, if required for normal operation and maintenance, shall be supplied with the equipment in accordance with the Contract Documents and where noted, as specified herein.

B. Provide all special tools required for normal maintenance. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.

C. Provide to the Owner a list of all spare and replacement parts with individual prices and location where they are available.

PART 2 – PRODUCTS

2.1 COMBINATION AIR VALVE ASSEMBLY

A. The valve assembly shall be furnished and installed as per the Combination Air Valve standard detail shown within the Construction Drawings.

B. The use of a Manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

C. Valves shall be of the size shown on the construction Drawings or as noted; equipment of the same type shall conform to the Approved Equipment List and the models specified in these Specifications.

D. The combination air valve assembly shall be from the list below, also shown in the Approved Equipment List (AEL), or an approved equivalent.

Manufacturer	1" NPT x 5/64"	2" NPTx3/32"
Empire Controls	945 (1" NPT)	945
Val-Matic	201C	202C
Apco	143C	145C

E. The combination air release shall be designed to vent accumulated air automatically. The outlet orifice shall be sized properly to facilitate valve operation at pressures of up to 150 psi. The air release valve shall be simple-lever, compound-lever, ball and orifice, or rolling seal depending upon volume requirements and the design of the valve.

F. The combination air release valve shall be designed with the inlet and outlet of equal cross-sectional area where applicable. The valve shall be capable of automatically allowing large quantities of air to be exhausted during the filling cycle and also capable of automatically allowing air to re-enter the system to prevent a negative pressure at water column separation or during the draining cycle. The float shall be guided to minimize premature closure by air and to provide proper alignment for normal closure by floating on the water surface.

G. Combination air release valves shall provide for both automatic air release under system pressure and to allow air movement during filling or draining operations or water column separation. The combination air valve may be housed in a single casting. The housing shall be designed to incorporate conventional or kinetic flow principles to properly vent the air without premature closure. Flanged sized (4 inch and larger) may be furnished in a dual housing. When dual casings are used a bronze manual isolation valve shall be installed if indicated by the manufacturer.

This will allow the air release valve to be serviced when the system is under pressure. Field service of the valve may also be performed by closing the isolation valve between the air valve and the pipe connection.

2.2 SURFACE PREPARATION AND PAINTING

A. Notwithstanding any of these Specifications, all coatings and lubricants in contact with potable water shall be certified as acceptable for use with that fluid.

B. If the manufacturer's requirement is not to require finished coating on any interior surfaces, then Manufacturer shall so state and no interior finish coating will be required, if acceptable to the Owner.

C. Clean and prime coat all ferrous metal surfaces of each valve in the shop.

D. Coat all machined, polished and non-ferrous surfaces including gears, bearing surfaces and similar unpainted surfaces with a corrosion prevention compound which shall be maintained during storage and until equipment begins operation.

PART 3 – EXECUTION

3.1 INSTALLATION - GENERAL

A. Combination air release valve and vault assembly shall be installed per the Manufacturer's instructions in the locations shown, true to alignment and rigidly supported. Any damage to the items listed above shall be repaired to the satisfaction of the Owner before they are installed.

B. Before setting these items, the Contractor shall check all Drawings and figures which have a direct bearing on their location. The Contractor shall be responsible for the proper location of valves and appurtenances during the construction of the work.

C. All materials shall be carefully inspected for defects in construction and materials. All debris and foreign material shall be cleaned out of openings, etc.

D. All items (including valve interiors) shall be cleaned prior to installation, testing, disinfection, and final acceptance.

E. The galvanized iron pipe on the combination air valve is to be installed next to a fence or property and/or R.O.W. line. A 3” 6-foot-tall aluminum post shall be installed to stabilize the galvanized pipe.

3.2 INSTALLATION OF MANUAL OPERATIONAL DEVICES

A. Unless otherwise noted, all operational devices shall be installed with the units at the factory, as shown on the construction drawings or as acceptable to the Owner, to allow accessibility to operate and maintain the item and to prevent interference with other piping, valves and appurtenances.

3.3 INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

A. Take care not to over pressure valves or appurtenances during pipe testing. If any unit proves to be defective, it shall be replaced or repaired to the satisfaction of the Owner.

3.4 AIR RELEASE VALVE MARKER

A. The Contractor shall furnish and install a combination air release valve marker for each air release valve installed in accordance with the Air Release Valve Standard Detail.

3.5 HYDROTESTING AND DISINFECTION

A. Hydrotesting and disinfection shall be in accordance with Section 01350 of these Specifications.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be for each installed complete and functioning combination air valve and assembly of various sizes with valve marker as accepted by the Owner.

4.2 PAYMENT: Payment shall be compensation all labor, materials, testing, and equipment necessary for furnishing and installing a complete and functioning combination air valve assembly of various sizes as per the construction drawings and as specified herein. This item shall also include, but not necessarily be limited to: all sizes of combination air valves and assemblies; combination air valve marker; approved tapping saddle; corporation stop; copper tubing; brass ball valve with lever; brass nipple threaded; box; vault box lid; galvanized iron pipe and fittings; security enclosure; accessories and appurtenances; painting; excavation and backfill;; trenching; selected embedment material; anti-corrosion embedment when specified; hydrotesting and disinfection and all other work incidental to the installation of combination air valve assembly complete and in reliable service.

END OF SECTION

SECTION 02500
ABANDONMENT OF WATER INFRASTRUCTURE

PART 1 – GENERAL

1.1 SCOPE

A. The work included within this section consists of furnishing all material, equipment, and labor while performing all operations necessary for abandoning water mains, valves, water service lines and/or fire hydrants as shown within the drawings and specified herein.

1.2 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 02650, PVC Pipe for Water Mains

C. Section 02660, Ductile Iron Pipe

D. Section 02665, HDPE Pipe

E. Section 02670, Ductile Iron Fittings

PART 2 – PRODUCTS

A. A cement-based grout shall be used to fill the void of the existing water main. The grouting material must have strength of at least 100 psi and shall have flow characteristics appropriate for filling the water main. The grout mix design and method of installation shall be approved by the Engineer prior to beginning operation.

B. Plugs and Clamps: Applicable for type of pipe to be plugged

PART 3 – EXECUTION

3.1 WATER MAIN ABANDONMENT

A. The Contractor shall accomplish all cutting, capping, plugging, and blocking necessary to isolate existing mains retained in service from abandoned mains.

B. Do not begin to cut, plug, and abandonment operations until replacement water main has been constructed and tested, all service connections have been installed, and replacement main is approved for use.

C. For water mains that are 6 inches in diameter and larger, the open ends of abandoned mains and all other openings or holes in such mains occasioned by cutting or removal of outlets shall be blocked off by pressure forcing cement grout into and around the openings in sufficient quantity to provide a permanent substantially watertight seal.

D. All pipe ends of abandoned water mains (both smaller diameter and larger diameter grouted filled pipe) shall be plugged. Pipes less than 24 inches in

diameter shall be plugged with a manufactured plug suitable for the particular type of pipe. The plug provided must be watertight and adequate to seal the pipe from groundwater.

E. When specified or shown within the contract documents, Contractor shall remove the main and all related appurtenances that are to be replaced or will no longer be in service. All effort to accomplish this requirement will be considered subsidiary to the work required, and no direct payment will be made.

F. In no instance shall water mains be abandoned by valve closure.

3.2 WATER VALVE ABANDONMENT

A. Valves to be abandoned in place shall have the rising stem, ductile iron shaft casing and cap removed and backfilled and buried. The valve covers shall be salvaged and returned to the Owner.

3.3 WATER SERVICE LINE ABANDONMENT

A. All water service lines that are being abandoned and not transferred to a new distribution line shall be disconnected at the corporation stop at the main and all other valves and appurtenances, including the water meter and backflow device, removed.

B. Unless otherwise specified, the old service line shall be abandoned after the existing meter has been reset in the existing or new meter box.

C. The Contractor shall accomplish all cutting, capping, and plugging necessary to isolate new service lines transferred to new and existing mains from those abandoned. The corporation stop for an abandoned service line tapped on a ferrous main shall be removed, and the tap at the main shall be plugged with an appropriately sized brass plug. For a non-ferrous main the corporation stop shall not be removed from the main. Instead, the corporation stop shall be closed, and the flared nut shall be removed from the corporation stop. After the appropriately sized copper disc is inserted inside the flared nut, replace the flared nut on the corporation stop. The Contractor shall salvage copper service line tubing, brass fittings, and other materials as directed by the Inspector and return them to Owner.

3.4 FIRE HYDRANTS

A. Fire hydrant branches shall be abandoned by cutting and capping the fire hydrant cast iron tee at the service main and the service restored to its original condition.

B. The contractor shall salvage the existing fire hydrants and other materials as designated in the field by the Inspector and shall deliver this material to 2370 FM 1979, San Marcos, TX 78666.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Unless shown on the construction plans or called out within the technical specifications as a pay item, abandonment activities described herein are for informational purposes only. No separate measurement of abandonment activities will

be made by the Contractor for this work.

4.2 PAYMENT: The abandonment of existing water infrastructure will be considered subsidiary to the work required. No separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 02510
REMOVAL OF WATER INFRASTRUCTURE

PART 1 – GENERAL

1.1 SCOPE

A. The work included within this section consists of furnishing all material, equipment, and labor while performing all operations necessary for removing water mains, valves, water service lines and/or fire hydrants as shown within the drawings and specified herein.

1.2 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01240, Trench Excavation Safety

C. Section 02650, PVC Pipe for Water Mains

D. Section 02660, Ductile Iron Pipe

E. Section 02665, HDPE Pipe

F. Section 02670, Ductile Iron Fittings

PART 2 – EXECUTION

2.1 WATER MAIN REMOVAL

A. The Contractor shall remove existing water main when so designated in the plans or as directed. When an existing water main is encountered that is not shown in the plans, do not remove until Engineer is notified of its presence and has directed its removal.

B. Do not begin removal operations until replacement water main has been constructed and tested, all service connections have been installed, and replacement main is approved for use.

C. Remove pipe in sections so traffic is maintained. Remove existing water main so nearby facilities will not be damaged. Material removed that is not deemed to be salvageable is the property of the Contractor. Dispose of removed material off the right of way in conformance with federal, state, and local regulations.

D. Backfill excavation and voids to the original ground line if resulting from the removal of water mains. Place backfill that will support any portion of the roadbed or embankment to the same requirements for placing embankment. Backfill other areas in 10-in. layers, loose measurement, and compact to the density of adjacent undisturbed material.

E. Avoid damage to materials shown on the plans to be salvaged. Deliver materials to be retained by the Owner. Block up salvaged steel materials off the ground.

2.2 WATER SERVICE LINE REMOVAL

F. All water service lines that are being removed shall be removed along with all other valves and appurtenances, including the water meter and backflow devices.

PART 3 – MEASUREMENT AND PAYMENT

3.1 MEASUREMENT: The quantity measured for payment shall be per linear foot of water main removed regardless of trench depth.

3.2 PAYMENT: Payment shall be full compensation for all labor, materials, and equipment necessary for removing the water main per linear foot regardless of trench depth as per the drawings and as specified within. This item shall also include, but not necessarily be limited to removing pipe, hauling pipe, and all excavating and backfilling that may be necessary; and all other work incidental to restoring the disturbed ground to pre-project conditions or better.

END OF SECTION

SECTION 02640
FIRE HYDRANT ASSEMBLY

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all material, equipment, labor, and performing all operations necessary for the supply of fire hydrants, ductile iron pipe, valves, nozzles, markers and accessories as shown within the Construction Drawings and specified herein.

B. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 DESCRIPTION OF REQUIREMENTS

A. The Contractor shall furnish and install fire hydrants in accordance with the Fire Hydrant Assembly drawing as shown within the Drawings.

1.3 QUALITY ASSURANCE

A. Install fire hydrants to meet current requirements of Owner.

B. Provide manufacturer's certificate for those products that meet or exceed minimum requirements as specified herein.

1.4 RELATED SECTIONS

A. Section 01230, Excavation and Backfill.

B. Section 01350, Hydrotesting and Disinfection

C. Section 02400, Valves and Appurtenances

D. Section 02660, Ductile Iron Pipe

E. Section 02680, Joint Restraints and Thrust Blocking

1.5 REFERENCED STANDARDS

A. AWWA C502 – Dry-Barrel Fire Hydrants.

B. AWWA C550 – Protective Interior Coatings for Valves and Hydrants.

C. Fire hydrants shall be NSF-61 certified.

1.6 SUBMITTALS

A. Submit Manufacturer’s certificates of conformance to the requirements of these Technical Specifications.

B. Shop Drawings: Submit Manufacturer's drawings and data sheets for material to be supplied under this section. Indicate sizes and types of fire hydrants to be installed.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. During loading, transportation and unloading, exercise care to prevent damage to materials.

B. Handling: Fire hydrants should be unloaded carefully. The hydrant should be carefully lowered from the truck to the ground, not dropped. Only hoists and slings with adequate load capacity to handle the weight of the hydrant shall be used.

C. Storage: Hydrants should be stored in the fully closed position to prevent entry of foreign material that could cause damage to the seating surfaces. Whenever practical, hydrants should be stored indoors. If outside storage is required, means shall be provided to protect the operating mechanism from contamination or weathering. In outside storage, parts and flanges shall be protected from the weather and foreign materials.

PART 2 – PRODUCTS

2.1 STANDARD CRYSTAL-CLEAR SUD FIRE HYDRANTS

A. Fire hydrants shall conform to the requirements of the latest revision of AWWA C502 "Dry- Barrel Fire Hydrants" or latest revision thereof. Hydrant barrel shall have safety breakage feature above the ground line. All hydrants shall have 6-inch mechanical joint shoe connections, two (2) 2 ½-inch hose nozzles and one (1) 4 ½-inch pumper nozzle with caps fitted with cap chains. Connection threads shall conform to National Standard Specifications as adopted by the National Board of Fire Underwriters.

Operating nut shall be a 1 ½-inch pentagon, measure from flat to point, and shall open left (counterclockwise). Main valve shall have 5 ¼ -inch fill opening and be of the compression type, opening against water pressure so that valve remains closed should the barrel be broken off.

B. Operating stem shall be equipped with anti-friction thrust bearing to reduce operating torque and assure easy opening. Stops shall be provided to limit stem travel. Stem threads shall be enclosed in a permanently sealed lubricant reservoir with O-ring seals.

C. Fire hydrants shall be designated for 150 psi working pressure and shop tested to 300 psi pressure with main valve both opened and closed. Under test, the valve shall not leak, the automatic drain shall function, and there shall be no leakage into the bonnet.

D. Fire hydrant shall be the following:

1. Mueller Super Centurion 250 (Model A 423).
2. American Darling (Model B-84-B).
3. Approved equivalent.

2.2 FIRE HYDRANTS (INSTALLED WITHIN NEW BRAUNFELS AND SAN MARCOS JURISDICTIONAL AREAS)

A. Lower barrel shall be rigid to assure above ground break at traffic feature.

Bury length of hydrant shall be four (4) feet minimum, five (5) feet maximum (hydrant lead pipe may be elbowed up from main using restrained joints; flanged joints in lead pipes are not allowed). Flange type connections between hydrant shoe, barrel sections and bonnet shall have minimum of 6 corrosion resistant bolts.

1. New Braunfels fire hydrant barrel shall have an inside diameter of not less than 7 inches. Hydrant shall have non-rising stem.

B. Hydrant Main Valves (for New Braunfels fire hydrants only) shall be 5 ¼ I.D. Valve stem design shall meet requirements of AWWA C502, with Operating Nut turning clockwise to close. Operating Nut shall be pentagonal, 1 ½ -inch point to flat at base, and 1 7/16 inches at top and 1-inch minimum height. Seat ring shall be bronze (bronze to bronze threading) and shall be removable with light weight stem wrench. Valve mechanisms shall be flushed with each operation of valve; there shall be a minimum of two (2) drain ports.

C. Outlet Nozzles shall be located approximately 18 inches above ground. Each hydrant shall have two (2) 2 ½ inch (63.5 mm) nozzles 180 degree apart with National (American) Standard Fire Hose Coupling Screw Thread NFPA 1963 Nozzles shall be threaded or cam-locked, O-ring sealed and shall have type 302 or 304 stainless steel locking device. Nozzle caps (without chains) and cap gaskets shall be furnished on the hydrant. The cap nut shall have the same configuration as the operating.

1. New Braunfels fire hydrants shall have one (1) 4-inch pumper nozzle with City of New Braunfels standard 4-480.

2. San Marcos fire hydrants shall have one (1) 4-inch pumper nozzle with City of Austin standard thread-six (6) threads per inch “Higbee” cut, 4.8590 inch O.D., 4.6425 inch root diameter.

D. Hydrant shall have double O-ring seals in a bronze stem sheath housing to assure separation of lubricant from water and shall have a weather cap or seal, or both, as approved by the Owner, to provide complete weather protection.

E. All below ground bolts shall be corrosion resistant. The hydrant valve shall be Neoprene, 90 durometer minimum. The seat ring, drain ring, operating nut and nozzles shall be bronze, AWWA C-502 current, containing not over 16 percent zinc. Break-away stem coupling shall be of ferrous material; its retaining pins, bolts, nuts, etc. of type 302 or 304 stainless steel.

F. Fire hydrants shall be designated for 200 psi working pressure and shop tested to 400 psi pressure with main valve both opened and closed. Under test, the valve shall not leak, the automatic drain shall function, and there shall be no leakage into the bonnet.

G. Fire hydrant shall be the following for San Marcos jurisdictional areas:

1. Mueller Super Centurion 250 Model A 423.

2. American Darling (Model B-84-B-5).

3. Approved equivalent.

H. Fire hydrant shall be the following for New Braunfels jurisdictional areas:

1. Mueller Super Centurion 250 Model A 423
2. American Darling (Model B-84-B).
3. Approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall field stake proposed hydrant installation locations for Owner and/or Engineer confirmation and field relocation, if necessary. The Contractor shall provide a minimum of seven (7) calendar days for the Owner and/or Engineer to review/approve the field stake locations and field relocations.

B. Fire hydrant shall be set plumb with not less than two and one-half (2.50) cubic feet of crushed stone.

C. The Contractor shall place a blue-colored reflective marker at a location in the adjacent roadway in accordance with the Marker Details Standard drawing.

D. Before installing any valve, care shall be taken to see that all foreign material is removed from the interior of the body and the valve is opened and closed to see that all parts are in proper working condition. Valves shall be closed prior to installation. Valves shall be set on gravel or ¾-inch stone with a minimum of one (1) square foot bearing area and four (4) inches thick to support the weight of the valve. Valves shall be set plumb with valve boxes placed directly over the operators. The top section of the valve box shall be set to allow equal movement above and below finished grade. After being correctly positioned, fill shall be carefully tamped around the valve box for a distance of four (4) feet on all sides of the box. In unpaved areas, a 24 inches x 24 inches x 9 inches thick reinforced concrete pad shall be poured around the top of the box as shown in the Typical Iron Valve Box Standard detail drawing as shown within per the Construction Drawings. The box shall be adjusted flush with the finished grade. All fire hydrant valves shall be harnessed or restrained as shown.

E. Fire hydrants shall be set so that the bury line is flush with the surface of the proposed ground as recommended by the Manufacturer and shall be connected to the mains with main line tees, ductile iron pipe, gate valve and box, fittings, marker, all being part of the assembly. Hydrants shall be set on gravel or ¾-inch stone pad with a minimum of one (1) square foot bearing area and four (4) inches thick to support the weight of the hydrant. The fire hydrant valve shall be restrained back to the tee. After connections are made, the hydrants shall be set at such elevations that the connecting pipe and the distributing mains shall have the same depth of cover. All backfill around hydrants shall be thoroughly compacted to the surface of the ground. Hydrants shall be turned such that the hose nozzles are parallel with, or at a right angle to the curb with the pumper nozzle facing the curb or street, unless directed otherwise by the Engineer.

3.2 PAINT

A. The interior of the hydrant shoe shall be coated with fusion-bonded epoxy having a normal dry film thickness of 8 mils, conforming to ANSI/AWWA C550 and NSF 61.

B. After the fire hydrant has been installed, the exterior of the fire hydrants shall be painted with suitable primer and finished with oil-based aluminum paint. Paint shall be applied to all exposed metal surfaces above the hydrant base flange.

3.3 TESTING AND INSPECTION

A. All Fire Hydrant tests and inspections shall conform to ANSI/AWWA C502 Section 5.1 “Production Testing”, ANSI/AWWA C502 Section 5.2 “Prototype Testing”, and ANSI/AWWA C502 Section 5.3 “Inspection and Rejection” or latest edition thereof.

3.4 FIRE HYDRANT REPLACEMENT

A. The Contractor shall make every effort to maintain water service to existing fire hydrants throughout the construction period, unless otherwise approved by the Engineer.

PART 4 – MEASUREMENT AN PAYMENT

4.1 MEASUREMENT: Standard fire hydrants with 6-inch valve and box with marker sign will be measured by the unit of each as a fire hydrant assembly.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing and installing complete new standard fire hydrant with 6-inch valve and box with marker sign as shown within the Drawings and as specified herein. This item shall include, but not necessarily be limited to excavation and backfill, selected material, anti-corrosion embedment when specified, nipples, ductile iron pipe, and fittings inclusive of the tee from the main line pipe, polyethylene wrap, concrete pad, painting, valve marker, hydrotesting and disinfection, inspection and all other work incidental to furnishing and installing a fire hydrant assembly.

END OF SECTION

SECTION 02650

POLYVINYL CHLORIDE (PVC) PIPE FOR WATER MAINS

PART 1 - G E N E R A L

1.1 SCOPE

A. The Work included in this Section consists of furnishing all material, equipment, testing, and labor while performing all operations necessary for the installation of Polyvinyl Chloride (PVC) pipe that is compliant with all AWWA C900 and C905 standards as shown within the Drawings and as specified herein.

B. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of five (5) years of experience producing PVC pipe and shall show evidence of at least five (5) installations that are currently in satisfactory operation.

B. PVC pipe shall be the product of one manufacturer.

1.3 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01240, Trench Excavation Safety

C. Section 01350, Hydrotesting and Disinfection

D. Section 02670, Ductile Iron Fittings

E. Section 02680, Joint Restraints and Thrust Blocking

1.4 REFERENCE STANDARDS

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. ASTM D 1248, Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

2. ASTM D 1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

3. ASTM D 2122, Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

4. ASTM D 2241, Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

5. ASTM 2412, Standard Test Method for Determination of External Loading

Characteristics of Plastic Pipe by Parallel Plate Loading

6. ASTM D 2444, Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).

7. ASTM D 3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

8. ASTM F 477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

9. AWWA C 900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 4 In through 60 in (100 MM through 1,500 MM).

10. AWWA C 909 - Standard for Molecularly-Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 Inches through 12 Inches (100mm through 300 mm), for Water Distribution.

11. AWWA M23 – PVC Pipe – Design and Installation

1.5 SUBMITTALS

A. Shop Drawings

1. Submit Manufacturer’s drawings and data sheets for material to be supplied under this Section. Indicate sizes and types to be installed.

2. Submit Manufacturer’s certificate of conformance with referenced standards.

3. Submit Manufacturer’s specifications for the tracer wire. Indicate size and print legend to be installed.

4. Submit Manufacturer’s specifications for the detectable marker tape. Indicate size and color code to be installed.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Pipe shall be unloaded and inspected in accordance with the Manufacturer's instructions.

B. Pipe stored on the site shall be contained within the protective unit packages provided by the Manufacturer. If packages need to be opened, the pipe shall be stored on a flat surface and not in direct contact with the ground. Do not stack packages higher than four (4) vertical feet. Keep inside of pipe free from dirt and debris. Care shall be exercised to avoid compression damage to or deformation of the pipe.

C. All pipe segments that are stored shall be covered to provide protection from the sunlight.

D. Handle all material carefully at all times. Any pipe having a crack or which has received a severe blow shall be marked as rejected and immediately removed from the jobsite.

PART 2 - P R O D U C T S

2.1 PVC PIPE

A. PVC pressure pipe shall conform to the requirements of AWWA C900 with outside diameter equal to that of cast iron pipe, or to the requirements of AWWA C905 with outside diameter equal to that of cast iron or steel pipe.

B. All PVC pressure pipe shall be a rated DR 18 and blue in color unless otherwise noted on the plans.

C. PVC pipe shall be furnished in standard laying lengths of 20 feet (plus or minus one inch) unless stated otherwise.

D. PVC pipe marking shall include the following:

1. Manufacturer's name or trademark.

2. Standard to which it conforms.

3. Pipe dimeter size.

4. Material design code.

5. Pressure rating.

6. Standard Dimension Ratio (SDR) number or schedule number.

7. Laboratory seal or mark attesting to suitability for potable water use.

8. Manufacture date (date of installation shall not exceed one year from this date).

E. PVC for water applications shall be in full compliance with ANSI/NSF 61. Manufacturers shall maintain their NSF certification for the duration of the Contract and any extensions thereof.

2.2 SLICK BORE INSTALLATION METHOD

A. PVC pipe shall be Certa-Lok C900/RJIB (DR 18) for all pipe diameter sizes.

2.3 PIPE JOINT RESTRAINTS AND THRUST BLOCKING

A. Pipe joint restraints and thrust blocking shall conform to all requirements within Section 02680 of these Specifications.

2.4 DUCTILE IRON FITTINGS

A. All buried fittings shall be ductile iron with mechanical joints and shall conform to all requirements within Section 02670 of these Project Specifications.

2.5 PIPE JOINT LUBRICANT

A. The joint lubricant shall have been tested and approved for potable water service. No lubricant shall be used that will harbor bacteria or damage the gaskets.

2.6 PIPE TRACER WIRE

A. Tracer wire shall be installed for future use in locating pipe. Tracer wire shall be No. 12 AWG copper-clad steel, extra high-strength with minimum 150-lb break load and 30 mil HDPE insulation.

B. Tracer wire shall be taped or zip-tied to the main pipeline in a minimum of 60-inch increments.

C. Tracer wire shall be placed on all new PVC pipe whether it is installed by open trench, slick bore or jack and bore method.

D. A conductivity test shall be made on all wire installed. Tests and visual inspection shall be made at each valve box, meter box and listening port as applicable. Conductivity may be tested by using as electrical conductivity meter by attaching underground locating equipment and tracing the signal to each valve box and meter box. No acceptance or payment will be made on any section or reach of pipe installed that does not have a conductive electrical locator wire installed in accordance with the Drawings.

2.7 MARKER TAPE

A. Marker tape shall be installed as an additional pipe identification device when pipe is installed by open trench method only.

B. During the backfilling process, all water mains, service lines and system appurtenances shall have a continuous warning tape placed immediately above them and throughout their length at a depth of eighteen (18) inches above the utility line surface. The tape shall be six (6) inches wide. Tape material shall be formulated from 100 percent virgin polyolefin resins. Resins shall be pigmental for chemical stability and resistance to sulfide staining (color fastness). Tape shall be constructed by the mechanical (non-adhesive) lamination of two piles of three layers blown film in such a manner as to produce a bi-axially oriented structure. The tape shall be able to provide a 700 percent elongation prior to rupture as per ASTM-D882.

C. The warning tape shall be manufactured with a permanent American Public Works Administration (APWA) blue color pigment and at a maximum of every thirty (30) inches along its length, be imprinted with a continuous warning message as follows: “CAUTION: BURIED WATER LINE BELOW.”

2.8 WATER MAIN CROSSING MARKER

A. The Contractor shall install the water main crossing marker in accordance with the Marker Standard Detail drawing as shown within the Drawings.

B. The water main crossing marker shall be placed on Right-of-Way or fence line at all road crossings.

C. The water main crossing marker detail shall be used for water main detecting services.

PART 3 - E X E C U T I O N

3.1 PIPE UNLOADING AT THE SITE

A. Inspect each shipment of pipe and make provision for a timely replacement of any damaged material. Unload by hand or use canvas slings to avoid scratching the pipe. Do not slide or drag PVC pipe over an abrasive surface. Pipe with deep scratches shall be replaced with new pipe and removed from the site immediately.

B. Stack pipe packages no higher than four (4) vertical feet and provide support for the pipe barrel to prevent bending of the pipe. Pipe stockpiled for more than thirty (30) days shall be covered to protect it from the sun's rays. Provide for air circulation through the stockpile.

C. Store rubber gasket rings in a cool, dark place out of the direct rays of the sun.

3.2 DISTRIBUTING PIPE ALONG THE TRENCH

A. Distribute pipe by hand. Do not drop or drag pipe. Distribute sufficient pipe for one day's work, and place with bell end in the direction of pipe laying. Prevent dirt and contaminants from entering the pipe.

3.3 ASSEMBLING THE PIPE

A. Closely follow the Manufacturer's recommended procedure for cleaning, setting the gasket ring, lubricating the spigots end of pipe, and assembling.

3.4 PIPE PLACING IN TRENCH

A. Pipe that is assembled prior to placing in the trench shall be carefully fed by hand (or with the use of approved equipment) on the pipe bed. Provide pockets in the pipe bed material to accommodate bell ends and eliminate a concentration of load at these points.

3.5 PREVENTING TRENCH WATER FROM ENTERING PIPE

A. When pipe laying is not in progress, close the open ends of pipe with a watertight plug and allow no water or other objectionable materials to enter the pipe.

3.6 WATER MAIN INSTALLATION

A. The Contractor shall start his work at a tie-in point or as designated by the Engineer/Owner. Pipe shall be laid with bell ends facing in the direction of the pipe laying, unless otherwise authorized or directed by the Owner. All valves and fire hydrants and valves must be installed as soon as the pipe laying reaches their designated location.

B. All pipes shall be installed to the required lines and grades with fittings, valves, and hydrants placed at the required locations. The pipe shall be laid by inserting the spigot end into the bell flush with the intersection line or as recommended by the Manufacturer. At no time shall the bell end be allowed to go past the “insertion line”. A gap between the end of the spigot, and the adjoining pipe is necessary to allow for expansion and contraction.

C. New water main crossing any other utility shall have a minimum of 30 inches of cover over the top of the pipe, unless otherwise modified by the Engineer. Excavation around other utilities shall be done at least 12 inches all around. Any damage to other utilities shall be reported to their governing entity. In both of these cases of existing utility damage, the Contractor shall promptly notify the Inspector.

D. Water main crossings of other utility lines shall be made in accordance with all applicable TCEQ rules and regulations.

3.7 HYDROTESTING AND DISINFECTION

A. Hydrotesting and disinfection of PVC pipe shall be completed in accordance with Section 01350 of these Specifications.

3.8 TRENCH EXCAVATION SAFETY

A. Trench excavation safety shall be provided by the Contractor in accordance with Section 01240 of these Specifications.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot for each size diameter and type of PVC pipe installed by open cut method regardless of trench depth as accepted by the Owner.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing and installing the PVC pipe per linear foot of the various diameter size and types by the open cut method regardless of trench depth as per the Drawings and as specified within. This item shall also include, but not necessarily be limited to all types and sizes of PVC pipe; tracer wire; marker tape; water main crossing marker; selected embedment; compaction; hydrotesting and disinfection; project staking; excavation and backfill; all items related to trench excavation safety; and all other work incidental to the installation of the PVC pipe complete in place and in reliable service.

END OF SECTION

SECTION 02660
DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all material, equipment, labor, testing and performing all operations necessary for the supply of all ductile iron piping within the limits of work, as shown on the Drawings and specified herein.

B. Where references are made to other standards or codes unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Manufacturer shall have a minimum of five years of experience producing ductile iron pipe and fittings and shall show evidence of at least five installations in satisfactory operation.

2. Ductile iron pipe and fittings shall be the product of one manufacturer.

B. Material Qualifications

1. All pipe, fittings and other materials supplied under this contract shall be subject to inspection while still on the delivery truck. It is the sole responsibility of the vendor and supplier to make prior contact with the Owner and provide a minimum of 48-hours prior notice of delivery.

2. Materials found to be defective, not in strict compliance with the quality standards of samples supplied, or of these specifications shall be immediately returned to the vendor at no expense of the Owner. If defects are discovered at a later time, the vendor shall be required to remove said items and shall bare all costs for so doing together with any replacement costs. Rejection of items may subject the vendor to liquidated and/or actual damages as specified elsewhere herein.

1.3 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01240, Trench Excavation Safety

C. Section 01350, Hydrotesting and Disinfection

D. Section 02670, Ductile Iron Fittings

E. Section 02680, Joint Restraints and Thrust Blocking

1.4 REFERENCE STANDARDS

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. AWWA C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105, Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
3. AWWA C110, Ductile-Iron and Gray-Iron Fittings,3 inches through 48 inches, for Water and Other Liquids.
4. AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C115, Flanged Ductile-Iron Pipe with Threaded Flanges.
6. ANSI A21.50, Standard for Thickness Design of Ductile-Iron Pipe.
7. ANSI A 21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids
8. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
9. ANSI B18.2.1, Square and Hex Bolts and Screws Inch Series, Including Hex Cap Screws and Lag Screws.
10. ANSI B18.2.2, Square and Hex Nuts.
11. ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
12. ASTM A 354, Specification for Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners.

1.5 SUBMITTALS

A. Submit Manufacturer’s certificate of conformance with Standards.

B. Submit Manufacturer’s drawings and data sheets for material to be supplied under this section. Indicate sizes and types to be installed.

C. Submit Manufacturer’s specifications for marker tape.

1.6 DELIVERY, STORAGE AND HANDLING

A. During shipping, delivery and installation of pipe and accessories, handle in a manner as to ensure a sound, undamaged condition.

B. Exercise particular care not to injure pipe coatings.

PART 2 – PRODUCTS

2 . 1 DUCTILE IRON PIPE

A. Ductile iron pipe for water applications shall be in full compliance with ANSI/NSF 61. Manufacturers shall maintain their NSF certification for the duration of the Contract and any extensions thereof.

B. All pipes thickness and outside diameter of pipe for water usage shall conform to Table 1 (Standard dimensions of push-on-joint and mechanical-joint ductile-iron pipe) and Table 2 (Dimensions for special thickness classes of push-on-joint ductile-iron pipe and mechanical-joint ductile-iron pipe) from ANSI/AWWA Standard C151/A21.51 for the following sizes. (The pressure class specified is the minimum permitted):

Pipe Diameter Size	Pressure Class (psi)
3-inches through 12-inches	350
14-inches through 20-inches	250
24-inch	200
30-inches through 64-inches	150

C. For restrained joint pipe, the thickness of the pipe barrel remaining after grooves are cut, if required in the design of restrained end joints, shall not be less than the nominal wall thickness of equal sized non-restrained joint pipe as shown above.

D. Each piece of pipe shall be marked as required in Section 4.7 of AWWA C151-Letters and numerals on pipe sizes 12-inch and smaller shall be not less than 3/8-inch.

E. The single gasket push-on pipe shall be shipped in standard 20-foot lengths, but not both. The restrained single-gasket push-on joint pipe shall be shipped in standard 20-foot lengths as specified above or fabricated lengths as noted in each order. At least two lengths of each size of single gasket push-on pipe furnished under each order shall be tested with circumferential gauges to ensure that the pipe may be cut at any point along its length and have an outside diameter which will be within the Manufacturer's standard design dimensions and tolerances for plain pipe. These lengths shall be identified with an easily distinguished, painted marking, longitudinally along the full length of the pipe.

2.2 DUCTILE IRON FITTINGS

A. Ductile iron fittings shall be in accordance with Section 02670 of these Specifications.

2.3 LININGS AND COATINGS

A. Asphaltic Coating

1. All pipe and fittings shall be outside coated with an asphaltic material applied by means of the airless spray method. The exterior coating shall meet AWWA Specifications for this type of coating, shall be smooth without pinholes, thin, bare, or overly thick areas. Smoothness

shall be such that when hand rubbed, no “sandpaper” feeling will be experienced and such that the spigot area will readily slide through the gasket without pulling, tearing, rolling, or otherwise disturbing the sealing capabilities of the gasket. Spigot ends shall be beveled prior to painting and to an extent that will permit ready insertion of the spigot through the gasket area.

B. Interior Cement-Mortar Lining

1. Pipe and fittings for potable water use shall be cement-lined and seal-coated in accordance with ANSI/AWWA Standard C104/A21.4-95, "Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water."

C. Exterior Painting

1. All exterior, above grade ductile iron piping, valves, and fittings, excluding stainless steel hardware, shall be prepared for painting by:

a. Cleaning all surfaces as per NAPF 500-03-01 Solvent Cleaning to remove all oil, grease, factory-applied tars and/or bitumastic coatings and all other soluble contaminants.

b. Preparing ductile iron pipe as per NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe providing a minimum 1.5 mil angular anchor profile.

c. Preparing ductile iron valves and fittings as per NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings.

2. Following surface preparation, the following coating system shall be applied:

a. First Coat: Tnemec Series 27WB Typoxy applied at 6.0 to 8.0 dry mils.

b. Second Coat: Tnemec Series 27WB Typoxy applied at 6.0 to 8.0 dry mils.

c. Third Coat: Tnemec Series 740 UVX applied at 3.0 to 5.0 dry mils.

d. Total minimum dry film thickness shall be 13.0 mils.

e. The Coatings colors shall be selected by the Owner using a color chart supplied by the Contractor with shop drawing submittals.

2.4 PIPE MARKER TAPE

A. Marker tape shall be used as a buried pipe identification service.

B. During the backfilling process, all Ductile Iron water mains, service lines and system appurtenances shall have a continuous warning tape placed immediately above them and throughout their length at a depth of eighteen (18) inches above the utility line surface. The tape shall be six (6) inches wide. Tape material shall be formulated from 100 percent virgin polyolefin resins. Resins shall be pigmential for chemical stability and resistance to sulfide staining (color fastness). Tape shall be constructed by the mechanical (non-adhesive) lamination of two plies of three layers blown film in such a manner as to produce a bi-axially oriented structure. The tape shall be able to provide a 700 percent

elongation prior to rupture as per ASTM-D882.

C. The warning tape shall be manufactured with a permanent American Public Works Administration (APWA) blue color pigment at a maximum of every thirty (30) inches along its length, be imprinted with a continuous warning message as follows: “CAUTION: BURIED WATER LINE BELOW.” At tees, tape ends, etc., the warning tape shall be tied together (spliced) with a knot to create a continuous warning tape throughout the length of the pipeline and associated branch lines, appurtenances, etc.

2.5 WATER MAIN CROSSING MARKER

A. The Contractor shall install the water main crossing marker in accordance with the Marker standard detail drawing as shown within the Drawings.

B. The water main crossing marker shall be placed on the Right of Way or fence line at all road crossings.

C. The water main crossing marker detail shall be used for water main detecting services.

PART 3 - EXECUTION

3.1 General

A. The Contractor shall provide all barricades and/or flashing warning lights necessary to warn of the construction throughout the Project.

B. Pipe and fittings shall at all times be handled with great care to avoid damage. In loading and unloading, they shall be lifted with cranes or hoists or slid or rolled on skidways in such manner as to avoid shock. Under no circumstances shall this material be dropped or allowed to roll or slide against obstructions.

C. All work shall be performed by skilled workmen experienced in similar installations.

D. All pipes shall be adequately supported by clamps, brackets, straps, concrete supports, rollers, or other devices as shown and/or specified. Supports or hangers shall be spaced so that maximum deflection between supports or hangers shall not exceed 0.05 inches for pipe filled with liquid, but shall not be further than 6 feet apart, whichever is closer, unless otherwise shown.

E. All pipe supports shall be secured to structures by approved inserts or expansion shields and bolts.

F. All pipe shall be thoroughly cleaned internally before being installed. All pipes, except oxygen service, air and gas, shall be flushed with water and swabbed to assure removal of all foreign matter before installation. Air and gas piping shall be tapped with a hammer to loosen scale or other foreign matter that might be within the pipe, then thoroughly blown with a high-pressure air hose. Air shall be from the Contractor's air compressor.

G. Whenever possible, the pipe will be installed with minimum 48-inches of cover, however, due to the numerous utilities in the area, this burial depth could change substantially.

H. At all horizontal or vertical pipe deviations, the Contractor shall install both restrained pipe and thrust blocks. Joints may only be opened to adjust alignment by half of the AWWA or Manufacturer's recommended opening (which is smaller).

3.2 INSTALLATION OF PIPE, FITTINGS AND VALVES

A. All bends, tees, and plugs, unless otherwise specified, shall be backed with concrete thrust blocks to undisturbed ground. Provision shall be made to prevent concrete from adhering to plugs or bolts.

B. Bolts, nuts, and rubber gaskets for use in flanged and mechanical joints shall be stored under cover. Gaskets shall not be exposed to heat, light or any petroleum products, shall be kept clean and shall not be handled with greasy or dirty hands.

C. Before making up flanged joints in cast iron pipe and fittings, the back of each flange under the bolt heads, and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and wiped clean and dry.

D. Before laying the ductile iron pipe, all lumps, blisters and excess coal-tar coating shall be removed from the bell and spigot ends of each pipe and the outside of the spigot and the inside of the bell wire brushed and wiped clean and dry. The entire gasket groove area shall be free of bumps or any foreign matter which might displace the gasket.

E. The cleaned spigot and gasket shall not be allowed to touch the trench walls or trench bottom at any time. Vegetable soap lubricant shall be applied in accordance with the pipe Manufacturer's recommendations, to aid in making the joint. The workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Deflections shall be made only after the joint has been assembled.

F. Cutting of ductile iron pipe for inserting valves, fittings, etc., shall be done by the Contractor with a mechanical pipe saw in a neat and workmanlike manner without damage to the pipe, the lining, or the coating.

G. Unless otherwise directed, ductile iron pipe shall be laid with the bell ends facing in the direction of laying; and for lines on an appreciable slope, the bells shall, at the discretion of the Engineer, face upgrade.

H. Push-on and mechanical joints in ductile iron pipe and fittings shall be made in accordance with the Manufacturer's standards except as otherwise specified herein. Joints between push-on and mechanical joint pipe and/or fittings shall be made in accordance with AWWA Standard Specifications, "Installation of Ductile-Iron Mains and Their Appurtenances," C600-10, except that deflection at joints shall not exceed one-half of the Manufacturer's recommended allowable deflection, or one-half of the allowable deflection specified in AWWA C600-10, whichever is the lesser amount.

I. Flanged joints shall be used only were indicated on the Drawings. Before making up flanged joints in the pipeline, the back of each flange under the bolt heads and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and wiped clean and dry. Flange faces shall be kept clean and dry when making up the joint, and the workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of

sand or dirt. Bolts and nuts shall be tightened by opposites in order to keep flange faces square with each other, and to ensure that bolt stresses are evenly distributed.

J. Bolts and nuts in flanged and mechanical joints shall be tightened in accordance with the recommendations of the pipe Manufacturer for a leak-free joint. The workmen shall exercise caution to prevent overstress. Torque wrenches shall be used until, in the opinion of the Engineer, the workmen have become accustomed to the proper amount of pressure to apply on standard wrenches.

3.3 PIPE PROTECTION

A. Paint all uninsulated metal (ductile iron or steel) piping underground with two coats of asphaltic paint.

B. Wrap soil pipe that touches metal or is exposed to masonry with a layer of 6 mils polyethylene.

C. Spirally wrap all pipelines embedded in concrete with two layers of 30 lb. felt.

D. Coat all exposed threads on galvanized steel pipe after assembly with two coats of zinc chromate.

E. Cleaning and Testing: All the piping installed under this project shall be tested as follows and as directed by the Engineer.

1. All potable water piping shall be disinfected per AWWA standards.

2. No leakage shall be permitted for flanged or any other type of above ground piping.

F. Installation of Aboveground and Exposed Piping

1. Aboveground and exposed pipe fittings, valves and accessories shall be installed as shown or indicated on the drawings.

2. Piping shall be cut accurately to measurements established at the job site and shall be worked into place without springing or forcing, properly clearing all equipment access areas and openings. Changes in sizes shall be made with appropriate reducing fittings rather than bushings. Pipe connections shall be made in accordance with the details shown and Manufacturer's recommendations.

3. Open ends of pipelines shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system. Pipe supports and hangers shall be provided where indicated and as required to insure adequate support of the piping.

4. Welded connections shall be made in conformity with the requirements of AWWA Standard C206 and shall be done only by qualified welders. The Engineer may, at his option, require certificates that welders employed on the work are qualified in conformity with the requirements of this standard and/or sample welds to verify the qualifications of the welders. Before testing, field welded joints shall be coated with the same material as used for coating its pipe in accordance with the requirements of AWWA.

5. Flanged joints shall be made up by installing the gasket between the flanges. The threads of the bolts and the faces of the gaskets shall

be coated with a suitable lubricant immediately before installation.

6. Use of perforated band iron (plumber's strap), wire or chain as pipe hangers will not be acceptable. Supports for pipe less than 1-1/2 inches nominal size shall not be more than 9-feet on centers and pipe 2-inches nominal size and larger shall be supported at not more than 10-feet on centers, unless otherwise indicated. Supports for PVC pipe shall be spaced one-half the distance specified above unless otherwise indicated. Any noticeable sagging shall be corrected by the addition of extra supports at the Contractor's expense.

3.4 EXCAVATION AND BACKFILL

A. Excavation and backfill on all potable water lines and where otherwise noted, shall be in accordance with Section 01230 of these Specifications.

3.5 TRENCH SURFACE RESTORATION

A. The surface of the backfilled trench shall be restored to match the previous conditions. This shall include final grading, placement of topsoil and seeding, placement of sod, or other prepared or unprepared surfaces. Existing above grade items shall be replaced in-kind, including but not limited to fencing, concrete/asphalt surfaces, curbing, vegetation (shrubs, plantings, trees, etc.) mailboxes, signage, etc.

3.6 FIELD QUALITY CONTROL

A. All water mains shall be flushed to remove all sand, debris, rock, and other foreign matter.

B. Dispose of the flushing water without causing a nuisance or property damage.

C. Pressure and Leakage Testing: All pumps, piping and gauges shall be furnished, installed, and operated by the Contractor and all such equipment and devices and their installation shall be approved by the Engineer.

D. Pump shall be of a non-pulsating type suitable for this application and gauge accuracy certification may be required at the Engineer's discretion. All pressure and leakage testing shall be done in the presence of a representative of the Owner as a condition precedent to the approval and acceptance of the system.

3.7 HYDROTESTING AND DISINFECTION

A. Hydro testing and disinfection shall be in accordance with Section 01350 of these Specifications.

3.8 TRENCH EXCAVATION SAFETY

A. Trench and excavation safety shall be in accordance with Section 01240 of these Specifications.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot for each size diameter of ductile iron pipe installed regardless of trench depth and as accepted by the Owner.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing and installing the ductile iron pipe per linear foot of the various diameter sizes using the open cut method regardless of trench depth as per the Drawings and as specified within. This item shall also include, but not necessarily be limited to: all types and sizes of ductile iron pipe; marker tape; water main crossing marker; compaction; polyethylene sleeves and wraps; hydro testing and disinfection; project staking; excavation and backfill; dewatering; trenching; all items related to trench safety excavation; and all other work incidental to the installation of the ductile iron pipe complete and in place and in reliable service.

END OF SECTION

SECTION 02665
HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 – GENERAL

1.1 SCOPE

A. The Work included in this Section consists of all material, equipment, testing, labor and performing all operations necessary for the installation of High-Density Polyethylene (HDPE) pipe as shown in the Drawings and specified herein.

B. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of 5 years of experience producing HDPE pipe and shall show evidence of at least 5 installations in satisfactory operation.

B. HDPE pipe shall be the product of one Manufacturer.

1.3 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01240, Trench Excavation Safety

C. Section 01350, Hydrotesting and Disinfection

D. Section 02670, Ductile Iron Fittings

E. Section 0280, Joint Restraints and Thrust Blocking

1.4 REFERENCE STANDARDS

A. AWWA C651-14 – Disinfection Water Mains

B. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, 3/4 In. (19 mm) Through 3 In. (76 mm), for Water Services.

C. AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm) for Waterworks.

D. ASTM D2239 – Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

E. ASTM D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing.

F. ASTM D3035 – Standard Specification for Polyethylene (DR-PR) Based on Controlled Outside Diameter.

G. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

H. ASTM F714 – Standard Specification for Polyethylene (DR-PR) Based on Outside Diameter.

1.5 SUBMITTALS

A. Submit Manufacturer’s certificate of conformance.

B. Contractor shall submit Manufacturer’s drawings and data sheets for materials to be supplied under this Section. Indicate sizes and types to be installed.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Pipe shall be unloaded and inspected in accordance with the Manufacturer's instructions.

B. Pipe and fittings stored on the site shall be stored in the protective unit packages provided by the Manufacturer. If packages need to be opened, the pipe shall be stored on a flat surface and not in direct contact with the ground. Do not stack higher than four (4) feet. Keep inside of pipe and fittings free from dirt and debris. Care shall be exercised to avoid compression damage or deformation to the pipe.

C. All pipe, fittings, and adaptors that are stored shall be covered to provide protection from the sunlight.

D. Handle all material carefully at all times. Any pipe or fitting having gouges or cracks, or which has received a severe blow shall be marked rejected and immediately be removed from the work.

PART 2 - PRODUCTS

2.1 HIGH-DENSITY POLYETHYLENE (HDPE) PIPE

A. Materials

1. Pipe shall be a high density, extra high molecular weight polyethylene manufactured from first-quality high density polyethylene resin containing no additives, fillers, or extenders. The HDPE pipe shall have an ASTM D3350 cell classification of PE 345434C and shall meet or exceed the properties listed in table below.

2. The HDPE pipe shall be DriscoPlex 4100 IPS DR-11 (blue stripe) or approved alternate and shall bear the seal of approval of the National Sanitation Foundation (NSF).

Property	Specification	Unit	Nominal Value
Material Designation			PE 4710
Material	ASTM D-1248		III C 5 P34
Cell Classification	ASTM D-3350		445574C
Density	ASTM D-1505	gm/cm^3	0.960
Melt Index	ASTM D-1238	gm/10 min.	0.08
Flex Modulus	ASTM D-790	Psi	120,000
Tensile Strength	ASTM D-638	Psi	3,500
Compressive Strength	ASTM D-695	Psi	1,600
Tensile Strength @ Yield (Type VI Spec.)	ASTM D-638 (2”/min.)	Psi	3,500

Elongation @ Yield	ASTM D-638	%, minimum	8
Tensile Strength @ Break (Type VI	ASTM D-638	Psi	5,000
Elongation @ Break	ASTM D-638	%, minimum	800
Modulus of Elasticity	ASTM D-638	Psi	175,000

B. The inside and the outside surface of each length of pipe shall be free from nicks, scratches, and other surface defects and blemishes. The pipe shall be homogeneous throughout, free of any bubbles, voids, or inclusions.

C. The jointing areas of the barrel of each length of pipe shall be free from dents and gouges.

2.2 PIPE ADAPTORS

A. HDPE to PVC - Mechanical Compression Coupling with restraint – HDPE shall be restrained by electrofusion flex restraints; PVC pipe restrained using a tapered gripping ring. Stiffener inserts in the pipe bore are required for both HDPE and PVC pipes.

2.3 PIPE TRACER WIRE

A. Tracer wire shall be installed for future use in locating pipe. Tracer wire shall be No. 12 AWG copper-clad steel, extra high-strength with minimum 150-lb break load and 30 mil HDPE insulation.

B. Tracer wire shall be taped or zip-tied to the main pipeline in a minimum of 60-inch increments.

C. Tracer wire shall be placed on all new HDPE pipe whether it is installed by open trench, slick bore or jack and bore method.

D. A conductivity test shall be made on all wire installed. Tests and visual inspection shall be made at each valve box, meter box and listening port as applicable. Conductivity may be tested by using as electrical conductivity meter by attaching underground locating equipment and tracing the signal to each valve box and meter box. No acceptance or payment will be made on any section or reach of pipe installed that does not have a conductive electrical locator wire installed in accordance with the Drawings.

2.4 MARKER TAPE

A. Marker tape shall be installed as an additional pipe identification device when pipe is installed by open trench method only.

B. During the backfilling process, all water mains, service lines and system appurtenances shall have a continuous warning tape placed immediately above them and throughout their length at a depth of eighteen (18) inches above the utility line surface. The tape shall be six (6) inches wide. Tape material shall be formulated from 100 percent virgin polyolefin resins. Resins shall be pigmental for chemical stability and resistance to sulfide staining (color fastness). Tape shall be constructed by the mechanical (non-adhesive) lamination of two piles of three layers blown film in such a manner as to produce a bi-axially oriented structure. The tape shall be able

to provide a 700 percent elongation prior to rupture as per ASTM-D882.

C. The warning tape shall be manufactured with a permanent American Public Works Administration (APWA) blue color pigment and at a maximum of every thirty (30) inches along its length, be imprinted with a continuous warning message as follows: "CAUTION: BURIED WATER LINE BELOW."

2.5 WATER MAIN CROSSING MARKER

A. The Contractor shall install the water main crossing marker in accordance with the Marker Standard Detail drawing as shown within the Drawings.

B. The water main crossing marker shall be placed on Right-of-Way or fence line at all road crossings.

C. The water main crossing marker detail shall be used for water main detecting services.

PART 3 - EXECUTION

3.1 PIPE UNLOADING AT THE SITE

A. Inspect each shipment of pipe and fittings and make provision for a timely replacement of any damaged material. Unload by hand or use canvas slings to avoid scratching the pipe. Do not slide or drag HDPE pipe over an abrasive surface. Pipe with deep scratches shall be replaced with new pipe and removed from the site.

B. Pipe stockpiled for more than thirty (30) days shall be covered to protect it from the sun's rays. Provide for air circulation through the stockpile.

3.2 ASSEMBLING THE PIPE

A. Closely follow the Manufacturer's recommended procedure for cleaning, installing, and assembling the pipe.

3.3 MAKING HEAT FUSED JOINTS

A. Follow Manufacturer's recommended procedure and use only the recommended tools for prepping piping for heat fusion. All joints shall be made in strict conformance to ASTM F2620 - Standard Practice for Heat Fusion Jointing of Polyethylene Pipe and Fittings and ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene Plastic Fittings for Polyethylene Plastic Pipe and Tubing.

3.4 PREVENTING TRENCH WATER FROM ENTERING PIPE

A. When pipe laying is not in progress, close the open ends of pipe with a watertight plug and allow no water or other objectionable materials to enter the pipe.

3.5 HYDROTESTING AND DISINFECTION

A. Hydrotesting and disinfection of HDPE pipe shall be completed in accordance with Section 01350 of these Specifications.

3.6 TRENCH EXCAVATION AND SAFETY

A. Trench excavation safety shall be provided by the Contractor in accordance with Section 01240 of these Specifications.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot for each size diameter of HDPE installed regardless of trench depth and as accepted by the Owner.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing and installing the HDPE per linear foot of the various diameter sizes using the open cut method regardless of trench depth as per the Drawings and as specified within, unless otherwise paid for by another pay item. This item shall also include, but not necessarily be limited to all types and sizes of HDPE; tracer wire; marker tape; adaptors; water main crossing markers; hydro testing and disinfection; project staking; excavation and backfill; dewatering; trenching; selected embedment; compaction; all items related to trench excavation safety; and all other work incidental to the installation of the HDPE pipe complete and in place and in reliable service.

END OF SECTION

SECTION 02670
DUCTILE IRON FITTINGS

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, equipment and incidentals for performing operations necessary to furnish and install ductile iron fittings designed and manufactured to be used with ductile iron-pipe for potable water and wastewater as shown on the Drawings and as specified herein.

B. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of stated standard or code shall govern.

1.2 QUALITY ASSURANCE

A. The Owner/Engineer may inspect materials for conformance to the Drawings and Specifications herein.

1.3 RELATED SECTIONS

A. Section 02680, Joint Restraint and Thrust Blocking

B. Section 01350, Hydrotesting and Disinfection

1.4 REFERENCE STANDARDS

A. AWWA C110 – Ductile-Iron and Gray-Iron Fittings.

B. AWWA C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.

C. AWWA C153 – Ductile-Iron Compact Fittings.

D. ASTM F1674 – Standard Test Method for Joint Restraint Products for Use with PVC Pipe.

E. ASTM D4976 – Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

F. ASTM A536 – Standard Specification for Ductile Iron Castings.

1.5 SUBMITTALS

A. Shop Drawings

1. Submit Manufacturer’s certificate of conformance with referenced standards.

2. Submit Manufacturer’s drawings and data sheets for materials to be supplied under this Section. Indicate dimensions, materials, size, and weight.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the Work.

B. Handle all fittings and accessories carefully with approved handling devices. Do not drop or roll material off trucks.

C. Unload fittings and accessories to or as close to the place where they are to be installed as is practical to avoid unnecessary handling. Keep pipe interiors completely free from dirt and foreign matter.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON FITTINGS

A. Fittings shall be push-on, flanged, or mechanical joint as indicated on the Drawings.

B. Full body fittings shall conform with AWWA C110 for 3 inch through 48 inch for Water and other Liquids.

C. Compact fittings shall conform with AWWA C153.

D. Fittings shall be manufactured conforming to the requirements of ASTM A536.

E. Fittings designated for raw water or wastewater service shall be fusion bonded epoxy coated inside and outside meeting all the requirements of AWWA C116.

F. Fittings, including the joints and restraint systems, shall have a minimum pressure rating of 350 psi for 3-inch through 24-inch in diameter fittings. Minimum pressure ratings of 250 psi for all fittings of size greater than 24-inches in diameter. Testing shall be done in accordance with the procedures found in ASTM F1674.

G. The exterior of all fittings designated for finished or potable water service shall be provided with a petroleum asphaltic coating in accordance with the latest revision of AWWA C110 and AWWA C153 standards. The interior of all fittings designated for finished or potable water service shall be cement mortar lined in accordance with the latest revision of AWWA C104.

H. Fittings for 2-inch size shall be of manufacturers' standard design in accordance with applicable design standards of AWWA C110 and AWWA C153.

PART 3 - EXECUTION

3.1 DUCTILE IRON FITTINGS

A. Joint restraints and thrust blocking for ductile iron fittings shall be provided in accordance with Section 02680 of these Project Specifications.

B. Anti-corrosion protection consisting of polyethylene sleeve and asphaltic material for ferrous surfaces shall be applied to exterior surfaces of all fittings installed.

C. Approved adapters shall be used when necessary to provide a transition between pipes and/or fittings of different diameters.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity determined for payment shall be as measured by the total fittings weight in tons for the various sizes of fittings installed and as specified in the Drawings.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing and installing various sizes of fittings made at the unit price bid for each ton of fittings to the nearest one-hundredth of a ton of fitting weight installed. Subsidiary items at no separate cost shall include, but not necessarily be limited to the following: weights of glands, bolts, nuts, washers, gaskets (all types). These are considered subsidiary to the installation of fittings and no separate payment will be made for anti-corrosion protection; select anti-corrosion embedment material; joint restraints and thrust blocking; hydrotesting and disinfection, and all other work incidental to the installation various sizes of fittings in place and in reliable service.

END OF SECTION

SECTION 02675

PIPE ENCASEMENT

PART 1 - GENERAL

1.1 SCOPE

A. The work included in this section consists of furnishing all material, equipment, labor, and performing all operations necessary to install casing pipe and carrier pipe by trenchless or open trench methods, as shown on the Construction Drawings and specified herein.

B. Casing pipe for carrier pipe shall be provided and installed in accordance with the Casing Standard Detail drawing as shown within the drawings.

C. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 01140, Dewatering

B. Section 01220, Exploratory Excavation

C. Section 01230, Excavation and Backfill

D. Section 02650, PVC Pipe for Water Mains

E. Section 02665, HDPE Pipe

F. Section 02680, Joint Restraints and Thrust Blocking

1.3 REFERENCED STANDARDS

A. AWWA C206 – Field Welding of Steel Water Pipe

B. AWWA C210 – Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines

C. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-In. Through 60-In. (100 mm Through 1,500 mm)

D. ASTM A36 – Standard Specification for Carbon Structural Steel

E. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe

F. ASTM A139 – Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)

1.4 SUBMITTALS

A. Shop Drawings

1. Submit manufacturer’s certificate of conformance with referenced standards.

2. Submit manufacturer’s drawings and product data sheets for the materials

to be supplied under this section. Indicate sizes and types to be installed.

3. Submit manufacturer's specifications for tracer wire and marker tape.

PART 2 – MATERIALS

2.1 CARRIER PIPE

A. Polyvinyl Chloride (PVC) carrier pipe that is 4-inches in diameter shall be C900 DR 18, fully restrained through the casing.

B. Polyvinyl Chloride (PVC) carrier pipe shall be Certa-Lok C900/RJIB (DR 18) for 6-inch to 12-inch pipe diameter and Certa-Lok C905/RJ (or approved equal) for 16-inch to 24-inch pipe diameters.

C. High-Density Polyethylene (HDPE) carrier pipe as specified on the Construction Drawings and Specification Section 02665 – HDPE Pipes for all pipe diameter sizes.

2.2 STEEL CASING

A. Steel casing shall be new. Used casing pipe is not acceptable.

B. Steel casing pipe shall be standard weight or heavier conforming to ASTM A36, ASTM A135, ASTM A139, or other acceptable standard specification.

C. The diameter of the Steel casing shall be per the Casing Standard Detail or otherwise noted in the Construction Drawings.

D. Steel casing shall have a standard wall thickness of 0.375 inches.

E. Pipe joints shall be welded together in accordance with AWWA C206.

F. Lengths of encasement shall be per TAC§21.40(a)(2)(A) for crossing. The lengths of any encasement shall extend, as applicable, to within five feet of the right of way, two feet of a connecting longitudinal line, or five feet beyond the face of the curb, whichever is greatest. These lengths of encasement include areas under center medians and outer separations.

G. Length of encasement shall be a minimum of 5 linear feet, past the edge of road pavement or sidewalk along all other roadways, unless otherwise directed by the Engineer or governing authority.

2.3 PVC CASING

A. PVC casing shall be new. Used casing pipe is not acceptable.

B. The diameter of the PVC casing shall be per the Casing Standard Detail or otherwise noted in the Construction Drawings.

C. PVC casing shall be C900 DR 18.

D. Length of encasement shall be a minimum of 5 linear feet, past the edge of pavement or sidewalk along all other roadways, unless otherwise directed by the Engineer or governing authority.

2.4 HDPE CASING

A. HDPE casing shall be new. Used casing pipe is not acceptable.

B. The diameter of the HDPE casing shall be per the Casing Standard Detail or otherwise noted in the Construction Drawings.

C. HDPE pipe shall be PE 4710 DR 21 or approved equivalent.

D. Lengths of encasement shall be per TAC§21.40(a)(2)(A) for crossing. The lengths of any encasement shall extend, as applicable, to within five feet of the right of way, two feet of a connecting longitudinal line, or five feet beyond the face of the curb, whichever is greatest. These lengths of encasement include areas under center medians and outer separations.

E. Length of encasement shall be a minimum of 5 linear feet, past the edge of road pavement or sidewalk along all other roadways, unless otherwise directed by the Engineer or governing authority.

2.5 CASING SPACERS

A. Casing spacers are required for all carrier pipelines 4-inch and larger in diameter.

B. Casing spacers shall be placed within 2 feet of the ends of casing pipe. Subsequent spacers shall be placed a maximum of 10 feet apart within the casing, with at least 3 spacers per joint of pipe.

C. Casing spacers shall be made from T-304 stainless steel of a minimum 14-gauge thickness.

D. Casing spacers shall have a synthetic rubber or PVC liner to insulate the carrier pipeline from the spacer.

E. Casing spacers shall have 1.5-inch wide glass reinforced plastic or UHMW polymer runners to insulate the spacer from the casing pipe interior.

2.6 END SEALS

A. Casing end seals shall be made of 1/8” think neoprene rubber and include ½” wide T-304 stainless steel bandings.

2.7 PIPE TRACER WIRE AND MARKER TAPE

A. Tracer wire shall be installed for future use in locating pipe. Tracer wire shall be No.12 AWG copper-clad steel, extra high-strength with minimum 1,150-lb break load and 30 mil HDPE insulation.

B. Tracer wire shall be taped or zip-tied to the carrier pipe in a minimum of 60-inch increments.

C. Tracer wire shall be installed for all construction methods.

D. Marker tape shall be installed as an additional buried pipe identification device when pipe is installed by open trench method only.

E. During the backfilling process, all water mains, service lines and system appurtenances shall have a continuous warning tape placed immediately above them and throughout their length at a depth of eighteen (18) inches above the utility line surface. The tape shall be six (6) inches wide. Tape material shall be formulated from 100 percent virgin polyolefin resins. Resins shall be pigmental for chemical stability and resistance to sulfide staining (color fastness). Tape shall be constructed by the mechanical (non-adhesive) lamination of two piles of three layers blown film in such a manner as to produce a bi-axially oriented structure. The tape shall be able to provide a 700 percent elongation prior to rupture as per ASTM-D882.

F. The warning tape shall be manufactured with a permanent American Public Works Administration (APWA) color pigment (appropriate for the utility type) and at a max of every thirty (30) inches along its length, be imprinted with the applicable continuous warning message as follows:

1. CAUTION: BURIED WATER MAIN BELOW
2. CAUTION: BURIED FORCE MAIN BELOW
3. CAUTION: SANITARY SEWER LINE BELOW
4. CAUTION: SEWER LINE BELOW

2.8 WATER MAIN CROSSING MARKER

A. The Contractor shall install the water main crossing marker in accordance with the Marker Standard Detail drawing as shown within the Construction Drawings.

B. The water main crossing marker shall be placed on Right-of-Way or fence line at all roads and gas pipeline crossings.

C. The water main crossing marker detail shall be used for water main detecting services.

2.9 HYDROTESTING AND DISINFECTION

A. Hydrotesting and disinfection of carrier pipe shall be completed in accordance with Section 01350 of these Specifications.

PART 3 – CONSTRUCTION

3.1 PIPE JACKING

A. Suitable bore pits or trenches shall be excavated on each side of the roadway for the purpose of jacking operations, and for placing end joints of the pipe.

B. Bore and receiving pits shall be sheeted, shored, and braced according to OSHA minimum requirements. All excavations shall be adequately dewatered.

C. Jacking work should in no way interfere with the operation of streets, highways, railroads, and other facilities. Jacking operations shall not damage or weaken such facilities.

D. The pipe to be jacked shall be set on guides to support the section of the pipe being jacked, and to direct it in the proper line and grade.

E. Generally, the pipe shall be jacked from the downstream end towards the upstream end.

F. Any pipe that cannot be repaired to its original condition or is damaged in jacking operations shall be removed and replaced at the Contractor's expense.

G. Jacking pits shall be backfilled and compacted immediately upon completion of jacking operations.

3.2 EXCAVATION AND BACKFILL

A. Excavation and backfill shall be completed in accordance with Section 01230 of the Specifications.

B. Boring operations may include creating of a pilot hole which shall be bored for the entire length of roadway crossing. This shall be used as a guide for the larger hole to be bored. Water or drilling fluid may be used to lubricate cuttings.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot of casing pipe and carrier pipe installed and as accepted by Owner. Jack and bore method shall be measured from face to face of jacking pits.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, tools, and equipment necessary for installing encased pipe of the various diameter sizes and by various methods (i.e., jacking, boring, drilling, open cut) per the Construction Drawings and as specified within. This item shall include, but not necessarily be limited to, carrier pipe; casing pipe; casing spacers; liners; end seals; pipe tracer wire; marker tape; water main crossing marker; bore pits; excavation and backfilling; bracing, sheeting, and shoring; grout; compaction; hydrotesting and disinfection; and all other incidental work for furnishing and installing pipe casing and carrier pipe in reliable service.

END OF SECTION

SECTION 02680
JOINT RESTRAINTS AND THRUST BLOCKING

PART 1 – GENERAL

1.1 SCOPE

A. The work included in this section consists of furnishing all labor, materials, equipment, and incidentals for thrust blocking and joint restraint installation and adjustment, as shown on the drawings and as specified herein.

B. Thrust blocking and joint restraint system components shall be installed as shown on the drawings for both water mains and sanitary sewer force mains.

C. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of stated standard or code shall govern.

1.2 QUALITY ASSURANCE

A. The Owner/Engineer may inspect materials for conformance to the drawings and specifications described herein.

1.3 RELATED SECTIONS

A. Section 01500, Concrete for Structures
B. Section 01600, Concrete Encasement, Cradles, Cap and Seals
C. Section 02400, Valves and Appurtenances
D. Section 02640, Fire Hydrant Assembly
E. Section 02650, PVC for Water Mains
F. Section 02660, Dutile Iron Pipe
G. Section 02670, Ductile Iron Fittings

1.4 REFERENCE STANDARDS

A. AWWA C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.

B. AWWA C110 – Ductile-Iron and Gray-Iron Fittings.

C. AWWA C111 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

D. AWWA C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings.

E. ASTM A536 – Standard Specification for Ductile Iron Castings.

F. ASTM F1674 – Standard Test Method for Joint Restraint Products for Use with PVC Pipe.

1.5 SUBMITTALS

A. Shop Drawings

1. Pipe joint restraint system.

2. Polyethylene wrapping.

3. Poly tape.
4. Concrete

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

Joint restraints, gaskets, glands, bolts, nuts, and accessories shall be shipped in suitable protective containers.

A. Handle all joint restraints and accessories carefully with approved handling devices. Do not drop or roll material off trucks.
B. Unload joint restraints and accessories to or as close to the place where they are to be installed as is practical to avoid unnecessary handling. Keep all items completely free from dirt and foreign matter.

PART 2 – PRODUCTS

2.1 THRUST BLOCKING

A. The Contractor shall furnish and install anchorage and thrust blocking in accordance with the Thrust Blocking standard detail shown within the drawings and this specification.

B. Concrete used for thrust blocking shall be Class A conforming to Specification Section 01500 – Concrete for Structures.

a. All thrust blocking must be a minimum of 3,000 psi concrete.

2.2 PIPE JOINT RESTRAINT SYSTEMS

A. Unless otherwise noted, restraint systems to be used on Polyvinyl Chloride (PVC) pipes (AWWA C900) shall meet or exceed the ASTM Standard F1674, “Standard Test Methods for Joint Restraint Products for Use with PVC Pipe,” or the latest revision thereof. Restraint system used on ductile iron pipe shall meet or exceed AWWA Standard C111.

B. Underwriter Laboratories (U.L.) and Factory Mutual (F.M.) certifications are required on all restraint systems.

C. Each restraint system shall be packaged individually and include installation instructions.

D. Restraint rings for PVC pipe bells (AWWA C900) shall be made of ductile iron components. All ductile iron shall conform to ASTM A536.

E. All mechanical (joint) restraints shall be bidirectional.

F. Restraining joint types shall be manufactured by EBAA Iron Sales, Inc., Star Pipe Products and SIP Industries, as listed on the Approved Equipment List (AEL).

G. All mechanical restraint systems shall be capable of preventing movement of the pipe and withstanding the thrust in pounds for various line sized as follows:

Nominal Pipe Diameter (Inches)	Thrust (lbs. force)
2	750
3	1,500
4	2,700
6	6,000
8	10,400
12	24,000
16	40,000

2.3 RESTRAINER FOR PVC PIPE (C900) AND DUCTILE IRON PUSH-ON TYPE CONNECTIONS

A. Pipe restraints shall be utilized to prevent movement for push-on ductile iron or PVC (compression type) bell and spigot pipe connections or where a flexible coupling has been used to join two sections of plain-end pipe ductile iron or PVC pipe. The restrainer may be adapted to connect a plain end ductile iron or PVC pipe to a ductile iron mechanical joint (MJ) bell fitting. The restrainer must not be directionally sensitive.

B. The pipe shall be restrained by a split retainer band. The band shall be cast iron or ductile iron, meeting or exceeding ASTM A536, Grade 65. The inside face or contact surface of the band shall be of sufficient width to incorporate cast or machined non-directionally sensitive serration to grip the outside circumference of the pipe. The serration shall provide full (360 degrees) contact and maintain pipe roundness and avoid any localized points of stress. The split band casting shall be designed to “bottom-out” before clamping bolt forces (110 ft-lb minimum torque) can over-stress the pipe but will not provide full non-directionally sensitive restraint at the rated pressures.

C. Bolts and nuts used to attach the split retainer ring shall comply with ANSI B 18.2/18.2.2, SAE Grade 5. Restraining rods and bolts shall be of low alloy corrosion resistant high strength steel conforming to AWWA C111.

D. The split ring type non-directionally sensitive restrainer system shall be capable of a test pressure twice the maximum sustained working pressure listed in Section 2.7.B below and be for both ductile iron and/or PVC C900.

2.4 NON-METALLIC RESTRAINED JOINT PIPE AND COUPLINGS FOR PVC C900 TYPE CONNECTIONS

A. Gaskets for restrained coupling connections shall join two sections of factory grooved PVC (C900) pipe. The restrainer coupling must not be directionally sensitive.

B. The inside face or contact surface of the coupling connection shall be of sufficient width to incorporate a factory machined non-directionally sensitive groove in both pipe and coupling the grip the outside circumference of the pipe. The couplings

shall provide full (360 degrees) contact and maintain pipe roundness and avoid localized points of stress. The coupling shall be designed with an internal stop to align the precision-machined grooves in the coupling and pipe prior to installation of a non-metallic thermoplastic restraint spleen and will provide full non-directionally sensitive restraint at the rated pressures.

C. The non-metallic restrained joint pipe and couplings for PVC (C900) type non-directionally sensitive restrainer system shall be capable of use Class 200 (DR 18) pipe and be capable of a test pressure twice the maximum sustained working pressure listed in Section 2.7.B below.

D. The non-metallic restrained joint pipe and couplings for PVC (C900) restraint system shall consist of a pipe and couplings system produced by the same manufacturer meeting the performance qualifications of Factory Mutual (FM) and Underwriters Lab (UL).

2.5 FITTING RESTRAINT FOR DUCTILE IRON PIPE (ONLY)

A. Radial bolt type restrainer systems shall be limited to ductile iron pipe in conjunction with Mechanical Joint (MJ) bell end pipe or fittings. The system shall utilize a standard MJ gasket with a ductile iron replacement gland conforming to ASTM A 536. The gland dimensions shall conform to Standard MJ bolt circle criteria.

B. Individual wedge restrainers shall be ductile iron heat treated to a minimum hardness of 370 BHN. The wedge screws shall be compressed to the outside wall of the pipe using a shoulder bolt and twist-off nuts to insure proper actuating of the restraining system.

C. Standard MJ fitting tee-bolts and nuts shall be high strength steel conforming to AWWA C111 and AWWA C153.

D. Standard MJ gasket shall be virgin SBR meeting ASTM D-2000 3 BA 715 or 3 BA 515.

2.6 POLYETHYLENE WRAPPING

A. Polyethylene wrapping shall conform to the material requirements of the latest revisions of AWWA C105 and ASTM D4976.

B. The following physical properties shall be met:

1. Wrapping film shall be a nominal thickness of 8 mils.

2. Tensile strength shall meet or exceed 3,600 psi in accordance with ASTM D882.

3. Minimum elongation shall not be less than 800% of the test strip minimum test per the latest ASTM D882 test.

4. Minimum dielectric strength shall be 800V/mil thickness minimum in accordance with ASTM D149.

5. Minimum impact resistance shall be 600 grams in accordance with ASTM D1709 Method B.

6. The minimum propagation tear resistance shall be 2550 gf machine and transverse direction in accordance with ASTM D1922.

2.7 POLY TAPE

A. Poly tape shall consist of an elastomeric film backing of either polyethylene or plasticize polyvinyl chloride, coated on one side with a homogenous pressure-sensitive adhesive. Tape shall conform to Federal Specifications L-T-1512a and AWWAA C209.

B. MAXIMUM SUSTAINED WORKING PRESSURE REQUIREMENTS

1. The following are the working pressure requirements for various types of pipe unless otherwise noted on the Construction Drawings.

a. PVC (C900) pipe = 235 psi

b. Ductile Iron pipe – 250 psi

PART 3 – EXECUTION

3.1 THRUST BLOCKING

A. The Contractor shall furnish and install thrust blocking and anchorage in accordance with the Thrust Block Anchoring standard detail shown within the Drawings and this specification.

B. Thrust blocking must be placed at every fitting (i.e., cross, tee, bend, reducer, plug, cap), hydrant and valve.

C. Thrust blocking shall be placed between solid ground and the fitting to be anchored. The area of bearing on the pipe and the ground shall be as indicated in the Thrust Blocking detail. The blocking shall be placed so that the pipe, fittings, and joints are accessible for repair.

D. The trench shall be excavated at least 5 inches outside of the outermost projections of the pipe or appurtenance and the trench walls shaped or undercut according to the Thrust Blocking detail or as required to provide adequate space and bearing area for the concrete.

E. The pipe and fittings shall be adequately braced to prevent floating, shifting or straining of the pipe while the concrete block is being placed. The contractor shall be fully responsible for the sufficiency of such restraints.

F. Special ties and anchor fittings may be used in conjunction with the concrete blockings.

G. Pipe polyethylene wrapping shall be placed between the pipe or fitting and the concrete.

3.2 JOINT RESTRAINTS AND RESTRAINT LENGTH CALCULATIONS

A. Pipe restraint devices shall be installed according to the lengths prescribed in the Construction Drawings or as recommended by pipe manufacturer, whichever is

more restrictive.

B. The Engineer must calculate restraint lengths based on the pipe material, soil type, trench type, depth of bury, test pressure, fitting type and nominal pipe size. The calculated restraint lengths must be included on the Construction Drawings

C. Restraint length calculations shall be made available to the Owner upon request for the Owner's review and approval.

D. Each bend, tee and dead end shall have mechanical joint restraints at the location of the fitting and at each joint both upstream and downstream of the fitting for the length prescribed.

E. If the calculated restraint length does not fall on a joint, restraints shall be installed to the next furthest joint.

F. All joints for carrier pipe installed within a casing shall be restrained.

3.3 POLYETHYLENE WRAPPING AND TAPE

A. Polyethylene wrap shall be installed at ductile iron pipe joints as a sleeve two feet longer than the pipe joint. The sleeve shall cover the full length of the pipe joint, lap over one foot on each end of the adjoining pipe joint, lap over one foot on each end of the adjoining pipe joints and be secured with the minimum of two circumferential turns of poly tape.

B. Completely wrap ductile iron fittings and valves with a minimum of one-foot overlap on each end and appropriately taped using poly tape. No duct tape shall be used.

C. Polyethylene wrap shall be installed on joints and restraint system components for corrosion protection.

PART 4 – MEASUREMENT AND PAYMENT

A. MEASUREMENT: Joint restraints and thrust blocking are considered subsidiary to Section 02670, and no separate measurement will be made by the Contractor for this Work.

B. PAYMENT: Joint restraints and thrust blocking are considered subsidiary to Section 02670, and no separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 02690

TAPPING SLEEVES AND VALVES

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this section consist of furnishing all material, equipment, testing, labor and performing all operations necessary for the installation tapping sleeves and valves as shown on the Drawings and specified herein.

1.2 QUALITY ASSURANCE

A. Provide manufacturer's affidavit that all valves purchased for tapping of existing waterlines conform to applicable requirements of AWWA C500 and that they have been satisfactorily tested in accordance with AWWA C500.

1.3 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01350, Hydrotesting and Disinfection

C. Section 02670, Ductile Iron Fittings

D. Section 02680, Joint Restraints and Thrust Blocking

E. Section 02400, Valves and Appurtenances

1.4 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

1. AWWA C500 - Gate Valves 3 through 48 inches for water and wastewater service.

2. AWWA C110 - Ductile-Iron and Gray Iron Fittings for water service.

3. AWWA C207 - Steel Pipe Flanges for Waterworks Service – Sized 4 inch through 144 inch.

4. AWWA C223 - Fabricated Steel and Stainless Steel Tapping Sleeves.

1.5 SUBMITTALS

A. Shop Drawings

1. Submit Manufacturer’s certificate of conformance.

2. Submit Manufacturer’s drawings and data sheets for material to be supplied under this section. Indicate sizes and types to be installed.

PART 2 - P R O D U C T S

2.1 MATERIALS

A. Tapping Sleeves:

1. Tapping Sleeve Bodies: Carbon steel or ductile iron; in two sections to be bolted together with high-strength, corrosion-resistant, low-alloy, and steel bolts.

2. Branch Outlet of Tapping Sleeve: Mechanical joint or flange

a. Gasket: Affixed around recess of tap opening to preclude rolling or binding during installation.

3. Provide one of the following products:

a. Smith-Blair 623.

b. Mueller H-615.

c. Or Approved Equivalent.

B. Tapping Valves: Meet all requirements of Section 02400 within these Project Specifications with the following exceptions:

1. Inlet: Mechanical joint or Flange

a. Flange: AWWA C110 - Class 150 and higher; minimum eight-hole flange.

2. Outlet: Mechanical joint or push-on joint; to fit any standard tapping machine.

3. Valve Seat Opening: Accommodate full-size shell cutter for nominal size tap without any contact with valve body; double disc.

4. Open Left (CCW) operation only.

C. Tapping to Asbestos Cement (AC) Pipe

1. Mueller Style H-619 or approved equivalent.

2. Tapping AC pipe will require flush valve on tapping machines.

3. Contractor shall have experience with tapping to AC pipe and be approved by Owner.

PART 3 – EXECUTION

3.1 GENERAL

A. Install tapping sleeves and valves at locations and of sizes as shown on Drawings.

B. Thoroughly clean tapping sleeve, tapping valve and pipe prior to installation and in accordance with manufacturer's instructions.

C. When tapping concrete pressure pipe, size on size, use shell cutter one standard size smaller than waterline being tapped.

D. Do not use Large End Bell (LEB) increasers with a next size tap unless existing pipe is asbestos cement.

3.2 INSTALLATION

A. Tighten bolts in proper sequence so that undue stress is not placed on pipe.

B. Align tapping valve properly and attach it to tapping sleeve.

C. Make tap with sharp, shell cutter:

1. For 12-inch and smaller tap, use minimum cutter diameter one-half inch less than nominal tap size.

2. For 16-inch and larger tap, use manufacturer's recommended cutter diameter.

D. Withdraw coupon and flush all cuttings from newly-made tap. Coupon shall be submitted to Owner.

E. Wrap completed tapping sleeve and valve in accordance with Section 02680 within these Project Specifications.

F. Place concrete thrust block behind tapping sleeve (NOT over tapping sleeve and valve).

G. Block under valve using concrete blocks.

H. Request inspection of installation prior to backfilling.

I. Backfill in accordance with Section 01230 within these Project Specifications.

3.3 HYDROTESTING AND DISINFECTION

A. Hydrotesting and disinfection of tapping sleeves and valve shall be completed in accordance with Section 01350 of these Specifications.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Measurement for installation of tapping sleeves and valves as a single unit assembly is on a “per each,” basis.

4.2 PAYMENT: Payment shall include all labor, materials, testing, and equipment necessary for furnishing and installing complete functioning tapping sleeves and valves of various sizes as per the Drawings and as specified herein. This item shall also include, but not be limited to: all types and sizes of valves; excavation and backfill; trenching; restraining utility poles; hydrotesting and disinfection; all items related to trench excavation and safety; and all other work incidental to the installation of the tapping sleeves and valves complete in place and in reliable service.

END OF SECTION

SECTION 02700
WATER MAIN TIE-INS

PART 1 – GENERAL

1.1 SCOPE

A. The Work included within this Section consists of furnishing all material, equipment, and labor while performing all operations necessary for water main tie-ins as shown within the Drawings and specified herein.

1.2 RELATED SECTIONS

A. Section 01140, Dewatering
B. Section 01230, Excavation and Backfill
C. Section 01350, Hydrotesting and Disinfection
D. Section 02400, Valves and Appurtenances
E. Section 02650, PVC Pipe for Water Mains
F. Section 02660, Ductile Iron Pipe
G. Section 02665, HDPE Pipe
H. Section 02670, Ductile Iron Fittings

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 WATER MAIN TIE-INS

A. The Contractor shall make a water main tie-in from the new water main to the existing water main as shown within the Drawings or as directed by the Engineer.
B. The Contractor shall be responsible for all shutdowns and isolation of the existing water mains, and this includes the following:
    1. Customer notification of service shutdown.
    2. Dewatering the excavation.
    3. Cutting the pipe for connections.
    4. Any other requirements as recommended by the Inspector or Engineer in order to safely and accurately complete this effort.
C. All water main tie-ins shall be completed during normal work hours from 8 A.M.-5 P.M., unless the Contractor is otherwise directed by the Owner or the Engineer.
D. During construction, the planned shutdown and tie-in work shall be coordinated

through and approved by the Inspector or Engineer with a minimum of two weeks prior notice of such activity and accomplished at a time where it will be the least inconvenient for the customers.

E. No additional compensation will be provided to the Contractor for tie-ins that must be accomplished after normal working hours.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity that is measured, "per each," for payment shall be the actual number of water main connection of each class, type, and size that are furnished and installed by the Contractor for acceptance by the Owner.

4.2 PAYMENT: Payment shall be full compensation for all labor, equipment, and materials required for completing the water main connections of varying size as indicated within the Construction Drawings and described within the Technical Specifications. This item shall also include all items related to trench excavation and safety; and all other work incidental to the water main connections complete in place and in reliable service.

END OF SECTION

SECTION 02710
WATER SERVICES

PART 1 – GENERAL

1.1 SCOPE

A. The work included in this section consists of furnishing all material, equipment, labor, and performing all operations that consist of water service supply lines adjustment and installation as shown within the Construction Drawings and specified herein.

B. Water services shall be installed in accordance with the Service Standard Detail drawing as shown within the Construction Drawings.

C. Where references are made to other standards or codes, unless date references are indicated, the latest edition of said standard or code shall govern.

1.2 SUBMITTALS

A. Submit manufacturer's drawings and product data sheets for the materials to be supplied under this Section. Indicate sizes and types to be installed.

1.3 RELATED SECTIONS

A. Texas Department of Transportation (TxDOT) Item 00340, Dense-Graded Hot-Mix Asphalt (Small Quantity)

B. Section 01230, Excavation and Backfill

PART 2 – PRODUCTS

2.1 SERVICE SADDLES

A. Service saddle shall have an epoxy coated body with double stainless-steel straps and nuts with a pressure rating of not less than that of the pipe to which it is to be connected.

B. Saddle shall have a rubber gasket cemented to the body, with compatible threading between the saddle and corporation stop.

C. Saddle shall conform to AWWA C800 standards. The service saddle shall provide full support around the circumference of the outside diameter pipe size, providing a bearing area of sufficient width to ensure that the pipe will not distort when the saddle is tightened.

D. Single strap saddles are not acceptable for use of this application.

E. Approved Manufacturer, also shown within the Approved Equipment List (AEL), are listed below:

1. Smith - Blair.
2. The Ford Meter Box Company, Inc.

3. Mueller Water Products, Inc.
4. JCM Industries (for HDPE taps)
5. Or Approved Equivalent.

2.2 GATE VALVES USED FOR LONG SERVICE LINES

A. A 2-inch resilient wedge gate valve with non-rising stem (NRS) shall be used between the tapping saddle and service line for each long side service.

B. Gate valves shall have fusion bonded epoxy coating that complies with AWWA C550.

C. The valves shall meet a minimum rated working pressure of 250 psig.

D. The valves shall be certified to NSF 61 and comply with the latest edition of AWWA C509 or AWWA C515.

2.3 SERVICE LINES FOR LONG SERVICES

A. All long service lines shall be PVC Schedule 80 pipe, nominal pipe size (NPS).

B. Each long service line shall be installed at a minimum of 2 inches in diameter.

2.4 CORPORATION STOPS

A. Approved corporation stop shall be ¾-inch (I.P. x Comp) Ford #FB1100-3-G-NL, or approved equivalent.

B. The outlet shall be composed of a compression joint.

C. The corporation stop shall be pressure rated at 150 psi.

2.5 METER (CURB) STOPS

A. A curb stop shall be installed at the end of every customer service pipe at the customer's property line.

B. Meter (curb) stop brand shall be Ford as the approved Manufacturer, or approved equivalent.

C. Meter (curb) stops shall be angle style, ball type, with full port, tee handle, meter nut and lock wing without drain.

D. Pipe connections shall be suitable for the type of service pipe used.

E. All parts shall be brass with female iron pipe size connections or compression-pattern and shall be designed for a hydrostatic test pressure not less than 150 psi.

F. Curb stops shall be sized to match the meter size and conform to AWWA C800 and AWWA C901.

2.6 WATER METERS

A. Water meters shall be provided by the Owner.

2.7 METER BOXES

A. Meter boxes shall be manufactured by DFW Plastics, Model No. DFW1300.12.1C or DFW 1600X.12.1C, or approved equivalent.

2.8 METER BOX LIDS

A. Meter box lids shall be Model No. DFW1200.1.LID or DFW1500.1.LID, or approved equivalent.

B. The word “WATER” shall be cast into the cover or the lid.

PART 3 – EXECUTION

3.1 WATER SERVICE LINE INSTALLATION

A. A service supply line located between the water main, and the inlet side of the water meter is designated as a “water service line.” A service supply line located between the outlet side of the water meter to the point of connection within the limits of the customer’s lot or property is designated as the “customer’s yard piping.”

B. Existing meter and meter box relocation shall be included in the service line installation.

C. The Contractor shall trench and backfill in accordance with the Typical Trench Backfill Standard Detail drawing as shown within the Construction Drawings.

D. Saw cutting, excavation, backfill, and replacement of pavement shall be completed in accordance with the following Project Specifications, whichever are applicable:

1. TxDOT Item 0340, Dense-Graded Hot-Mix Asphalt (Small Quantity)

2. Section 01230, Excavation and Backfill

3.2 BORING SERVICE LINES

A. Bored casing inside diameter shall be 4-inches for 2-inch service lines in accordance with the Service Connection Standard Detail drawings as shown within the Construction Drawings.

B. HDPE casing shall be used when service lines are bored.

C. Schedule 80 PVC may be used for open cut installations.

D. Steel casing must be used for lateral encased crossings at all TxDOT roadways. HDPE casing may be used in lieu of steel casing per Figure: 43 TAC §21.40(a)(2)(A).

3.3 TAPPING PVC WATER MAINS

A. Single meter service shall include PVC adaptor coupling with corporation stop.

3.4 SINGLE SERVICE LINE- SINGLE AND DUAL METERS

A. Single service lines with single and dual meters shall conform to the Service Connection Standard Detail drawings as shown within the Construction Drawings.

3.5 TAPPING ASBESTOS CEMENT WATER MAINS (AC PIPE)

A. Service line tapping of AC pipe shall be completed during the period immediately before or after hydrostatic pressure testing operations so that subsequent flushing will maximize the elimination of contaminants associated with the tapping process.

B. Direct tapping into the pipe wall without use of a service saddle will not be allowed. Service saddles must be used when tapping AC pipe.

C. Drill tools shall be used for services less than 2-inches in size.

D. Shell type drills shall be used for all services 2-inches and greater in size.

3.6 RECONNECTING SHORT AND LONG SERVICE LINES

A. New water main(s) to which services are to be reconnected on the same side of the street as the old main, are defined as “short reconnects.” Existing services on the opposite side of the street of the new main shall be defined as “long reconnects.”

B. Both old and new water mains at existing service line connections shall be exposed.

C. The old water main shall be exposed for the purpose of gaining access to the existing service corporation stop and the new main for the purpose of installing the new corporation stop.

D. The new main shall be exposed for the purpose of being drilled and tapped with an approved tapping machine, a new corporation stop installed under pressure, and the trench extended laterally to expose a sufficient length of the existing service line to provide slack to bend it into position for tying to the new corporation stop.

E. After suitable notification to the customer, the Contractor shall “kill” the existing service by closing the corporation stop, removing the existing flare nut, inserting inside the existing flared nut an appropriately sized copper disc and replacing the existing flared nut on the corporation stop if the main is non-ferrous, or plugging the existing service line at the main if the main is ferrous.

3.7 RELOCATING SHORT AND LONG SERVICES

A. New water main(s) to which services are to be relocated and are on the same side yard of the street as the customer’s new meter box location, are designated as “short relocates.”

B. New water main(s) to which services are to be relocated and are on the opposite

side of the street from the customer's new meter box location, are designated as "long relocates."

3.8 NEW SHORT AND LONG SERVICES

A. If a new water main is required to be extended to provide water service for new customers, the service lines laid to be connected to the new water main shall be designated as "new services."

B. Newly laid water main(s) to which new services are on the same side of the street as the customer's new meter box location, are designated as "new short services."

C. Newly laid water main(s) to which new services are on the opposite side of the street from the customer's new meter box location, are designated as "new long services."

D. New services shall be installed in accordance with the Service Connection Standard Detail drawing as within the Construction Drawings.

E. All short services shall have their own individual saddle tap.

3.9 ABANDONMENT OF SERVICE LINES

A. The Contractor shall accomplish all cutting, capping, and plugging necessary to isolate new service lines transferred to new and existing mains from those that are to be abandoned.

B. The corporation stop for an abandoned service line tapped on a ferrous main shall be removed, and the tap at the main shall be plugged with an appropriately sized brass plug.

C. For a non-ferrous main, the corporation stop shall not be removed from the main. Instead, the corporation stop shall be closed, and the flared nut shall be removed from the corporation stop. After the appropriately sized copper disc is inserted inside the flared nut, replace the flared nut on the corporation stop.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT:

A. Reconnect short service will be measured by the unit of the various types and sizes of each service line reconnected.

B. Reconnect long service will be measured by the unit of the various types and sizes of each service line reconnected.

C. Relocate short service will be measured by the unit of the various types and sizes of each service line relocated.

D. Relocate long service will be measured by the unit of the various types and sizes of each service line relocated.

E. New short service will be measured by the unit of the various types and sizes of each new service line installed.

F. New long service will be measured by the unit of the various types and sizes of each new service line installed.

4.2 PAYMENT

A. Payments shall be full compensation for all labor, materials, testing, and equipment necessary for reconnecting short and long services made at the price bid unit for each service line of the various sizes reconnected as shown within the Construction Drawings and as specified herein. This item shall also include, but not necessarily be limited to: excavation and backfilling; dewatering; cutting pavement and surface structures of whatever type encountered and replacement with whatever type specified, polyethylene or copper, corporation stop, and service saddle for short or long service line reconnections.

B. Payments shall be full compensation for all labor, materials, testing, and equipment necessary for relocating short and long services made at the price bid unit for each service line of the various sizes relocated as shown within the Construction Drawings and as specified herein. This item shall also include, but not necessarily be limited to: excavation and backfilling; dewatering; cutting pavement and surface structures of whatever type encountered and replacement with whatever type specified, and polyethylene or copper tubing, meter box and lid (if meter box and lid need to be replaced) for short or long service line relocations.

C. Payments shall be full compensation for all labor, materials, testing, and equipment necessary for new short and long services made at the price bid unit for each service line of the various sizes installed as shown within the Construction Drawings and as specified herein. This item shall also include, but not necessarily be limited to: excavation and backfilling; dewatering; cutting pavement and surface structures of whatever type encountered and replacement with whatever type specified; casing; polyethylene or copper tubing, service saddle, corporation stop, meter box and lid, and ball valve for new short or long service line installations.

END OF SECTION

SECTION 02800
HANDLING ASBESTOS CEMENT PIPE

PART 1 – GENERAL

1.1 SCOPE

A. The Work includes all work specified herein, to include mobilization and demobilization, labor, materials, transportation, disposal fees, administrative fees, and incidental costs. Estimating areas, quantities, and weight are the sole responsibility of the Contractor.

B. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 02500 – Abandonment of Water Infrastructure

B. Section 02690 – Tapping Sleeves and Valves

C. Section 02700 – Water Main Tie-Ins

1.3 REFERENCE STANDARDS

A. National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 Code of Federal Regulations (CFR) 61

B. Occupational Safety and Health Administration (OSHA) 29 CFR 1926.1101

C. State of Texas Occupation Code, Chapter 1954 and Health and Safety Code Chapters 361 and 363

D. Texas Administrative Code (TAC) 25 Chapter 30

E. Texas Administrative Code (TAC) 25 Chapter 295

1.4 SUBMITTALS

A. At them Pre-construction Conference the following shall be submitted for review and approval to OWNER as required:

1. The Plan in accordance with: NESHAP, OSHA, this Section and State requirements. The number of copies submitted of the Plan is the same as the number of copies required under other bid submittal requirements with one copy being submitted electronically. The work plan shall provide detailed procedures for retaining the AC pipe's Category II, non-friable NESHAP classification. The contractor shall incorporate working with ACM and complying with mandated OSHA requirements for Class II, asbestos work in their project specific Safety and Health Plan. The guidance provided in these special specifications is not intended and does not constitute an asbestos abatement project design as described under 25 TAC, Chapter 295.

2. Submit proof satisfactory to OWNER that required permits, site location, and arrangements for transport and disposal of asbestos containing waste material (ACWM) have been made that meet Texas environmental statutes and regulations. Include the name of the transporter, their Texas asbestos transporter license number, and the name of the approved landfill where the AC pipe and ACM waste will be buried.

B. The plan submitted shall contain the following:

1. The scope of work to be accomplished shall be described in detail. Be specific as to the involvement with the existing AC pipe. For example: abandoning/removing X feet of AC pipe; tying into one or more joint(s)/section(s) of an existing water main and replacing one or more joints/sections (X feet) of pipe to make the connection; removing X feet of buried AC pipe encased in concrete crossing a drainage way not accessible by road; or connecting to an existing joint/section of AC pipe by tapping into the AC pipe.

2. Detailed procedures that describe the methods/techniques to be employed to uncover, dislodge, handle, remove, secure, transport, and dispose of the AC pipe and any generated ACM waste. For illustrative purposes only the following is an example of the level of detail expected in a plan. The contractor could use this example as a basis for preparing their plan. If the contractor employs this example, OWNER requires greater site-specific detail in the plan submitted.

- The material is classified by definition under 40 CFR 61, Subpart M, Section 61.141 as Category II, non-friable ACM, unless, when dry, it can be crumbled, pulverized, or reduced to powder by hand pressure. At that time, it becomes classified as regulated ACM (RACM) and subject to regulation under Subpart M. It is the intent of this specification to define procedures that maintain the AC pipe in an intact state. Contractors shall not use procedures that subject the AC pipe to forces that will crumble, pulverize, or reduce to powder the AC pipe. By using procedures that have a low to no probability of fiber release, the pipe retains its classification as Category II, non-friable ACM. These procedures will protect workers from the health risk associated with airborne asbestos.

- Definitions used and incorporated as part of this specification are in Appendix One. Applicable standards and guidelines used and incorporated as part of this specification are in Appendix Two.

- If the scope of the project may involve the threshold amount (260 linear feet or greater), a Demolition/Renovation Notification Form will be sent to DSHS by the Contractor. This form shall be post-marked no later than 10 working days prior to the start of any asbestos handling work. All projects involving AC pipe require that NESHAP and OSHA standards are met and/or exceeded. The contractor shall perform all work in a manner that meets or exceeds those standards. The contractor shall have and follow a written Plan that describes their detailed handling and disposal procedures of the AC pipe. The Contractor shall submit copies of the Plan to

OWNER for review and approval. OSHA requires that during any ACM disturbance, regardless of amount, the asbestos worker(s) shall be protected from potential airborne asbestos exposure in excess of the permissible exposure limit or excursion limit as stipulated in 29 CFR 1926.1101.

C. During Asbestos Handling and Disposal Activities: Submit copies to OWNER of all transport manifests, trip tickets, and disposal receipts for all ACWM removed from the work area during the project.

PART 2 - CONSTRUCTION REQUIREMENTS

2.1 This item shall consist of the uncovering, dislodging, handling, removing, transporting, and disposing of AC pipe, joints, wrappings, and other ACM. To comply with NESHAP and OSHA requirements, this project will require workers trained in using wet technique procedures to dislodge and remove AC pipe, AC pipe joints, valves (any type) containing ACM, and any surrounding soils that may contain ACM.

2.2 The Contractor shall develop an Asbestos Removal Work Plan, herein referred to as “the Plan”, (see Appendix Three, Example Procedures) that provides specific and detailed procedures they and/or any of their subcontractors will follow to maintain the AC pipe in an intact state. The Plan shall specify the wet techniques to be followed when the pipe collars are dislodged. The Plan shall include procedures/actions to be followed if the intact AC pipe becomes broken and the possibility exists of asbestos fibers becoming airborne. By regulatory definition, if and when the pipe and/or collar are broken, they become a regulated ACM (RACM) and subject to NESHAP. The Plan shall state or reference procedures in the contractor’s Safety and health program document that they will follow to comply with the federal OSHA asbestos standard. Finally, the Plan shall contain provisions for the environmentally compliant disposal of the intact AC pipe and any RACM created during the removal process. The Plan shall be provided to OWNER at the pre-construction meeting for its review and approval prior to initiating uncovering operations to verify the contractor has met the contractual requirements. No handling and disposing of OWNER AC pipe will begin without approval from OWNER. Any ACM encountered that is not OWNER pipe and not previously identified by OWNER or shown on OWNER plans will not be authorized for disposal payment. Preparation and submission of the Plan shall be considered subsidiary to the work required and no direct payment will be made.

2.3 The Contractor shall comply with agency requirements. Any uncovering, dislodging, handling, or disposing of AC pipe and associated written handling and removal plans, such as an abatement plan, required by another agency will be paid for by that agency using their specification/bid item number. Again, no handling and disposing of OWNER AC pipe will begin without approval from OWNER.

2.4 To meet and/or exceed NESHAP and OSHA guidelines, the contractor may subcontract the AC pipe handling plan and work to an Environmental Protection Agency (EPA) accredited and Texas Department of State Health Services (DSHS) licensed asbestos abatement contractor, DSHS licensed asbestos consultant, and DSHS air monitoring technician.

2.5 NESHAP guidelines apply to facility projects in which the combined amount of regulated asbestos containing material (RACM) is at least 260 linear feet (LF) or 35 cubic feet or 160 square feet. This means that if the combined amount of RACM is at least 260 linear feet of the AC pipe,

including AC collars, and it is expected to become or becomes crumbled, pulverized, or reduced to powder, then the project is subject to the NESHAP provisions of reporting and asbestos emission control paragraphs in 40 CFR Section 61.145. If the DSHS RACM limit of 260 linear feet is exceeded, the contractor is responsible for any DSHS administrative fees and fines. The contractor shall be responsible for submitting the DSHS notification with copies to OWNER.

2.6 Asbestos Removal Work Plan

If the project specifies an Asbestos Removal Work Plan (or, Asbestos Abatement Plan) be provided and approved as part of the project documents, the following guidelines should be used for the document to be considered acceptable. Refer to Appendix Three of this specification for more specific guidance of addressing an acceptable procedure for handling OWNER AC pipe. Plans submitted with insufficient detail will be returned requesting more information be provided.

A. The governing documents for OWNER asbestos-cement (AC) pipe are as follows:

1. U.S. Environmental Protection Agency (EPA), 40 Code of Federal Regulations (CFR) Part 61, Subpart M – National Emission Standards for Asbestos;
2. Occupational Safety and Health Administration (OSHA), 29 CFR 1926.1101, Asbestos;
3. The State of Texas Statute, Health and Safety Code, Chapter 363;
4. Texas Administrative Code (TAC) 30 TAC Chapter 330.

B. OSHA classifies the handling and removal of asbestos containing material (ACM) as Class II asbestos work. As such each contractor shall acknowledge that their program complies with OSHA standard 29 CFR 1926.1101 and shall describe how their program complies with that standard. It should be included in the contractor's submission meeting OWNER Spec 902, Safety and Health Program.

C. The OWNER AC pipe is considered by the U.S. EPA as Category II, non-friable asbestos containing material (ACM). The OWNER wants its pipe to retain that asbestos categorization. To accomplish that goal OWNER requires that no force be applied to the pipe that would cause it to become crumbled, pulverized, or reduced to powder by hand pressure unless wet techniques are used when a force is applied. Once the pipe becomes crumbled, pulverized, or reduced to powder it becomes classified as regulated ACM (40 CFR 61.141).

PART 3 - CONSTRUCTION REQUIREMENTS

3.1 The Contractor shall remove and double bag with 6-mil polyethylene sheeting to yield a total of at least 12-mil, the asbestos pipe in the trench or immediately when it comes out of the trench, seal, label, transport, and dispose of all Category II non-friable ACM and RACM in compliance with applicable current Federal, State, and local regulations, laws, ordinances, rules, standards and regulatory agency recommended requirements.

3.2 The Contractor shall notify OWNER and at least 72 hours prior to beginning uncovering, dislodging, handling, and removing the AC pipe. AC pipe uncovering, dislodging, handling, and/or removing shall be conducted during regular business hours, 8 a.m. to 5 p.m., Monday-Friday. No uncovering, dislodging, handling, and or removing of AC pipe outside of the normal business hours or during the weekend is allowed unless special circumstances require the contractor to do so, and the work has been approved in writing at least 72 hours before the commencement of the work.

3.3 Time is of the essence in removing the ACM from the project area. All work must be completed within the time period specified in the contract. OWNER will be responsible for coordinating this work in high-density areas, such as schools, church facilities, and residential areas.

3.4 All notifications required to state regulatory agencies will be made by the Contractor with copies provided to OWNER, but not limited to the DSHS Demolition/Renovation Notification Form. If 260 linear feet or greater of RACM pipe will become crumbled, pulverized, or reduced to powder, the project is subject to NESHAP regulations and a Demolition/Renovation Notification Form will be sent to DSHS by the Contractor. This form will need to be post-marked no later than 10 working days prior to the start of any asbestos disturbance.

3.5 The Contractor shall have an on-site supervisor, who is an OSHA Competent Person, present on the job site at all times that the AC pipe work is in progress. This supervisor shall be thoroughly familiar with and experienced at asbestos pipe handing using wet techniques and shall be familiar with and shall enforce the use of all safety procedures and equipment. He/she shall be knowledgeable of all applicable EPA, OSHA, and DSHS asbestos requirements and guidelines.

3.6 The Contractor has: sole and primary responsibility for the “means and/or methods” of the work; an obligation to OWNER to inspect all stages of the work; and sole responsibility to supervise the performance of the work.

3.7 The Contractor shall be responsible for site safety and for taking all necessary precautions to protect the Contractor’s, OWNER and the public from airborne asbestos exposure and/or injury. The Contractor shall be responsible for maintaining the integrity of the work area.

3.8 The Contractor shall confine operations at the site to the area requiring interface with the AC pipe and the general site area in close proximity to the project. The Contractor will not unreasonably encumber the site with materials or equipment. If ACWMs are required to be stored overnight in a secured area, the waste material and waste containers shall be labeled according to OSHA and EPA, and the State of Texas requirements, and containerized to preclude unauthorized disturbance of the ACWMs.

3.9 The Contractor shall be responsible for obtaining and coordinating waste disposal and transport of ACWM to a Texas Commission on Environmental Quality (TCEQ) permitted asbestos waste landfill. Waste manifests shall be generated for the transport of the AC pipe and ACWMs from the project site to the landfill disposal site.

3.10 SITE SECURITY

A. The Contractor shall demarcate the area of AC pipe interface (“regulated area”) with barrier tape and warning signs, per OSHA regulation 29 CFR 1926.1101. Access to the regulated area will be limited to authorized personnel and visitors. The Contractor shall identify in their site-specific safety and health plan how they intend to limit access and who is authorized to be in the demarcated area.

3.11 AC PIPE HANDLING

A. The Contractor shall uncover, dislodge, handle, remove, transport, and dispose of all AC pipe specified in the contract documents for this project using wet technique procedures. All work involving AC pipe and other ACM products must be addressed in the Plan. The Contractor shall take precautions to prevent damage to adjacent structures and

material/finished material not required for AC pipe handling.

B. Prohibited Work Practices and Engineering Controls: Contractors shall not use procedures that subject the AC pipe to forces that will crumble, pulverize, or reduce to powder the AC pipe. The following work practices and engineering controls shall **not** be used for work related to AC pipe or for work which disturbs ACM, regardless of asbestos exposure or the results of Initial Exposure Assessments:

1. High-speed abrasive discs and sanders not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air;
2. Carbide-tipped cutting blades;
3. Electrical drills, chisels, and rasps used to make field connections in AC pipe;
4. Shell cutters used to cut entry holes in AC pipe;
5. A hammer and chisel without using wet techniques to remove pipe connections;
6. Compressed air used to remove asbestos or material containing asbestos;
7. Dry sweeping, dry shoveling, or other dry clean-up of dust and ACM debris;
8. Employee rotation as a means of reducing employee exposure to asbestos.

C. General Removal Work Practices: See Appendix Three for an example of the detailed general work practices a contractor could use in preparing an Asbestos Removal Work Plan. If the contractor uses the example, they must expand upon the provisions in the appendix to describe its specific procedures. The appendix is provided for illustrative purposes only. If the contractor employs this example, OWNER requires greater site-specific detail to be included in the Plan submitted for approval.

D. Disposal bags for RACM shall be 6-mil polyethylene and labeled as required by EPA Regulation 40 CFR 61.150 (a)(1)(iv) or OSHA requirement 29 CFR 1926.1101(k)(8).

E. Stick-on labels identifying the generator's name and address, and the project site location shall be applied to any asbestos waste disposal bag that contains RACM, as per EPA or OSHA and Department of Transportation requirements.

F. Abandonment of AC water mains/pipes:

1. The Contractor is responsible for isolating the existing mains to remain in place by capping, plugging and blocking as necessary. The opening of an abandoned AC water main and all other openings or holes shall be blocked off by manually forcing cement grout or concrete into & around the openings in sufficient quantity to provide a permanent watertight seal. Abandonment of AC water mains will be considered subsidiary to the work required, and no direct payment will be made.

2. Abandonment of Valves that contain ACM: Valves to be abandoned in the execution of the work shall have the valve box and extension packed with sand to within eight inches (8″) of the street surface. The remaining eight inches (8″) shall be filled with 3,000 psi concrete or an equivalent sand-cement mix and finished flush with the adjacent pavement or ground surface. The valve covers shall be salvaged & returned to OWNER. The abandonment of valves containing ACM will be considered subsidiary to the work required, and no direct payment will be made.

3. Verification of Removal & Clean-up Procedures: The Contractor's on-site Competent Person shall inspect the work area, verify, and certify that no residual AC pipe fragments and debris remain.

G. Disposal Procedures: Submit copies to OWNER of all transport manifests, trip tickets, and disposal receipts for all asbestos waste materials removed from the work area during the project. The Contractor will sign manifests as the OWNER representative (generator) for the AC pipe and provide copies to OWNER Construction Inspections for final payment.

3.12 STANDARD PLAN NOTE

A. Asbestos Cement (AC) pipe contains asbestos-containing material (ACM) and is located within the project limits. Special waste management procedures and health and safety requirements are applicable when handling, removing, and disposing of this pipe. Measurement and Payment for such work is to be made under Section 02800 – Handling Asbestos Cement Pipe.

PART 4 - MEASUREMENTS AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot for each diameter size of Asbestos Cement (AC) pipe removed and properly disposed of and accepted by the Owner

4.2 PAYMENT: The work performed as prescribed by these items shall be paid for at the contract unit price bid per linear foot for "Removal, Transportation, and Disposal," which prices shall be full compensation for the work herein specified including the furnishing of all materials, equipment, tools and for the material disposal, submittals, and labor necessary to complete the Work. No payment shall be made for the Plan.

END OF SECTION

APPENDIX ONE: DEFINITIONS

As used anywhere in Section 02800 – Handling Asbestos Cement Pipe, including all appendices, the following shall be defined to mean:

A. Amended Water: Water to which a surfactant (wetting agent) has been added to increase the ability of the liquid to penetrate ACM.

B. Approval: Means the OWNER contract requirements have been met but does not mean that the OWNER stipulates any written documents adequately comply with federal and state occupational safety and health regulatory requirements.

C. Asbestos: A group of naturally occurring silicate minerals and includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that has been chemically treated and/or altered.

D. Asbestos Containing Material (ACM): Material or products that contain more than 1.0% of any kind of asbestos.

E. Asbestos Containing Waste Material (ACWM): Asbestos containing material or asbestos contaminated objects requiring disposal.

F. Authorized Personnel: Any person authorized by the Contractor and required by work duties to be present in the regulated area.

G. Authorized Visitor: OWNER representatives, and any representative of a regulatory or other agency having jurisdiction over the project.

H. Asbestos Consultant: A person licensed by the Texas Department of State Health Services to perform the following asbestos abatement related functions in public buildings:

1. Project design;
2. Asbestos surveys and condition assessment of ACM;
3. Asbestos Management Planning;
4. The collection of bulk material samples, airborne substance samples and the planning of sampling strategies;
5. Owner-representative services for asbestos abatement projects or O&M programs, including air monitoring and project management;
6. Consultation regarding regulatory compliance and all aspects of technical specifications and contract documents;
7. The selection, fit testing, and appropriate use of personal protection equipment & the development of asbestos related engineering controls.

I. Abatement Contractor: The company, agency, or entity licensed by the Texas Department of State Health Services that has been retained to perform asbestos abatement and other associated functions.

J. Class II Asbestos Work (OSHA Standard): Activities involving the removal of ACM, which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.

K. Competent Person: An individual, who is capable of identifying existing asbestos hazards in the workplace, can select the appropriate control strategy for asbestos exposure, and who has the authority to take prompt corrective measures to eliminate them.

L. Friable Asbestos: Asbestos containing material, that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure and includes previously non-friable material that has become damaged to the extent that, when dry, it may be crumbled, pulverized, or reduced to powder by hand pressure.

M. NESHAP: The National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61).

N. OSHA: The Occupational Safety and Health Administration.

O. Regulated Area: An area established by the Contractor or employer to demarcate areas where asbestos work is conducted and any adjoining area where debris and waste from such asbestos work accumulate; and an area within which airborne concentrations of asbestos exceed or there is a reasonable possibility they may exceed the permissible exposure limit.

P. Regulated Asbestos Containing Material (RACM): (1) Friable asbestos material; (2) Category I non-friable ACM that has become friable; (3) Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; or, (4) Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by forces expected to act on the material in the course of the demolition or renovation operations regulated by 40 CFR Part 61, Subpart M.

Q. Staging area: A pre-selected area where wrapped or containerized asbestos containing waste material will be placed prior to removal from the project site.

R. Surfactant: A chemical wetting agent added to water to improve penetration.

S. Uncovering operations: The use of mechanical, pneumatic, and/or manual procedures that disturb the material and/or soil above and/or around the AC pipe that would expose personnel to the AC pipe.

APPENDIX TWO: APPLICABLE STANDARDS AND GUIDELINES

All work under these specifications shall be done in strict accordance with all applicable Federal, State, and local regulations, standards, and codes governing asbestos disturbance, handling, removal, and disposal. Work activities shall also comply with OWNER related to safety and health. The most recent edition of any relevant regulation, standard, or code shall be in effect. Where there is a conflict between the regulations, standards, codes, and/or these specifications, the most stringent requirements shall apply.

As a minimum, the Contractor shall comply with the applicable portions of the following:

A. Occupational Safety and Health Administration (OSHA) including but not limited to:

1. Title 29 Code of Federal Regulations (CFR) Section 1926 – Safety and Health Regulations for Construction
2. Title 29 CFR Section 1926.1101 – Safety and Health Regulations for Construction - Asbestos.
3. Title 29 CFR Section 1910.134 – Occupational Health and Safety Standards - Respiratory Protection.
4. Title 29 CFR Section 1910.1020 – Occupational Health and Safety Standards - Access to Employee Exposure and Medical Records.
5. Title 29 CFR Section 1910.1200 – Occupational Health and Safety Standards - Hazard Communication.

B. Environmental Protection Agency (EPA) including but not limited to: Title 40 Code of Federal Regulations Part 61 Subpart M – National Emission Standard for Asbestos.

C. Texas Statutes, including but not limited to:

1. Occupation Code, Chapter 1954, Asbestos Health Protection
2. Health and Safety Code Chapters 361 and 363, Solid Waste

D. Texas Administrative Code including but not limited to:

1. Department of State Health Services, Title 25, Chapter 295, Subchapter C – Texas Asbestos Health Protection.
2. Texas Administrative Code, Title 30, Chapter 330Municipal Solid Waste.

E. Department of Transportation – Hazardous Materials Regulations 49 CFR, Parts 170 – 180.

APPENDIX THREE: EXAMPLE OF PROCEDURES FOR HANDLING AC PIPE

The following is an example of procedures for handling OWNER AC pipe. A contractor could use them as a basis for preparing an Asbestos Removal Work Plan. The contractor must expand upon the provisions of this appendix to describe its specific procedures. This appendix is provided for illustrative purposes only. The contractor is required to develop a site-specific Asbestos Removal Work Plan that complies with the provisions of this specification. If the contractor employs this example, OWNER will require greater site-specific detail to be included in the plan submitted for approval.

Scope of Work: Describe the work and be specific as to the intended involvement with the existing AC pipe. For example: abandoning/removing X feet of AC pipe; tying into a section of an existing waterline and replacing one section (X feet) of pipe to make the connection; or connecting into an existing section of AC pipe by tapping into the AC pipe.

A. Excavation to Pipe:

1. Excavate to within X inches/feet of the section of AC pipe to be replaced/removed. Depending upon the depth of the excavation, shoring may be needed following company procedures (provide or reference those procedures).
2. Once the pipe is located, excavate (by machine or hand) on one/both sides of the pipe to expose the collars and pipe. Dig the earth from around the collars by hand to create a clearance space completely around the collar. DO NOT SCRAPE OR ABRADE THE PIPE WITH THE EXCAVATION DEVICE(S).
3. Set up pumps to evacuate any residual water when the AC pipe is dislodged.

B. Wet Method Use:

1. Make the amended water solution by mixing 1 ounce of a liquid detergent (Dawn, Joy, other) with 2 to 3 gallons of water in a 2-to-3-gallon mist sprayer. Other size sprayers may be used.
2. Wet each portion of the pipe, normally just the collar, to be removed with the amended water (water/soap) solution.
3. Use the mist sprayer to produce a “mist” application and continuously wet the collars throughout the wrapping, cracking, and removal process. A worker shall be assigned to and is responsible for this procedure during the entire dislodging process.

C. Only Cracking AC Pipe Collars is Approved:

1. Wrap wet towels/burlap/other defined absorbent material around the collar. Wrap the collar with at least two layers of 6-mil polyethylene sheeting to provide a total of at least 12-mil. It is recommended that additional poly be used on the collars to minimize possible tearing of the plastic.
2. Place another layer of wet towels/burlap/ other defined absorbent material on the wrapped collar.
3. Use the flat head end of a sledgehammer to crack the collar while continuously “misting” the collar. Strike the collar on the side of the section of pipe to be removed to prevent the remaining section of pipe from being broken.
4. Put all of the pieces of collar into a 6-mil polyethylene waste bag. Look for small pieces that may have been generated during the cracking process, wet them, and place them in the waste bag.

NOTE: When the collars are cracked and removed from a shutdown waterline, residual water may drain from the dislodged AC pipe. Follow company safety procedures to control the water (provide or reference those procedures).

D. Double Bag All AC Waste Materials:

1. All visible AC pipe materials including collars, towels, rubber gloves, gaskets, and other items suspected of containing asbestos shall be double bagged using two (2) 6-milAC waste bags. The inner bag contents shall be mist sprayed with amended water or mixed with water from the trench prior to closing to maintain the contents wet. Close the bag when it is half full by twisting the top of the bag and sealing with moisture resistant tape.

2. If the asbestos waste bag is small enough, it may be placed inside the section of intact pipe before the pipe is wrapped in at least two layers of 6-mil poly. If placing the waste bag inside the pipe, do not force it causing it to tear.

E. Removal of Pipe and Waste Bag from Trench:

1. All sections of “intact” pipe shall be wrapped in a minimum of two (2) layers of 6-mil poly sheets (12-mil total) while in the trench and lifted out of the trench using only nylon slings. If the trench contains water, the pipe shall be lifted out of the trench using only nylon slings and placed on a minimum of two (2) layers of 6-mil poly sheets (12-mil total) on the ground next to the trench.

2. Wrap each pipe segment in at least 12-mil of poly and secure with tape.

3. Lift the ACM waste bag(s) from the trench and move it/them to a secure location to prevent accidental contact with the bag(s) that would cause it/them to tear.

NOTE: Any valves, bends, tees, fittings, or other items that have AC pipe connected shall be wrapped whole as required with the same minimum total of 12-mil of poly material.

F. AC Pipe and Waste Storage/Transfer:

1. Wrapped AC pipe and ACM waste bags shall be stored in a secure area away from traffic that could damage the wrapped pipe and/or waste bags while awaiting transport to the permitted landfill.

2. If daily transport to a permitted landfill cannot be provided, a roll-off type dumpster/disposal container may be used to hold only the wrapped AC pipe and bagged RACM waste to prevent damage to the wrapping.

(1) DO NOT TOSS THE PIPE OR WASTE BAGS INTO THE ROLL-OFF OR DISPOSAL CONTAINER.

(2) DO NOT MIX SPOILS WITH THE AC WRAPPED PIPE AND AC WASTE.

3. All wrapped or bagged materials shall be moved to the AC pipe/waste fenced holding area for storage. If a roll-off or other type disposal container is used, place the wrapped pipe and waste bags in the roll-off/container using methods that do not cause the wrapping/bagging to be torn.

4. Any bagged or wrapped materials that are torn in handling shall be mended and taped. If the tear is too extensive for a simple tape repair, wrap/bag with an additional equivalent of 12-mil minimum thickness of poly wrap/bagging.

5. AC Pipe and Waste Disposal: The wrapped AC pipe and ACM bagged waste shall be transported to an approved AC waste landfill with the manifests being generated at the time of transfer. Include the name of the transporter, their Texas asbestos transporter

license number, and the name of the permitted landfill where the AC pipe and ACM waste will be buried.

SECTION 03000
BYPASS PUMPING

PART 1 – GENERAL

1.1 SCOPE

A. The Work covered by this Section consists of furnishing all labor, supervision, tools, equipment, appliances, and materials to perform all operations in segment(s). The purpose of bypass pumping is to prevent sewage overflows and always provide reliable sewer service to the users of the sanitary sewer. The Contractor shall maintain sewage flow in the construction area to prevent back-up and/or overflow into upstream pipe segments and laterals, adjacent ditches, storm sewers, and waterways.

B. Bypass pumping is the installation and operation of bulkheads, plugs, hoses, piping, temporary manholes and sumps, and pumps to maintain wastewater flow and prevent backup and overflow. Bypass pumping provides continuous sewer service to the users of the sanitary sewer system while maintenance or construction operations are in progress by diverting flow, when necessary, around the construction location and pumping it to a downstream manhole.

1.2 SUBMITTALS

A. Submittals shall comply with the requirements in the Contract Documents.

B. The Contractor shall submit a written plan for implementation and sequencing of bypass pumping for review and approval of the Engineer prior to installation of the bypass system. The plan shall include details such as:

1. Project information including the project name, location, and permit number (from plan cover sheet).
2. Contact information for Contractor or submitting entity that includes the company name, contact person (24 hours/day), phone number(s), and fax number.
3. Calculations of static lift, friction loses, and flow velocity, (pump curves showing pump operating range shall be submitted).
4. Proposed pump capacity
5. Proposed size and type of hoses
6. Location of downstream discharge
7. Show any special features were pipes or hoses cross roadways, drainage features, temporary trenches, support bridges, etc.
8. Show temporary manholes, sumps, and connections required for bypass pumping.
9. Staging areas for pumps including a schematic showing the arrangement and layout of the pumping and bypassing facilities at various stages in the work.

10. Sewer plugging method and types of plugs.
11. Length, size, material, location, and method of installation of suction piping, temporary manholes, or temporary sumps (if required).
12. Length, size, material, location, method of installation and location of discharge piping.
13. Pump manufacturer, model, sizes, capacity, and number of each size to be on site and power requirements.
14. Standby power generator size, location (if required).
15. Downstream discharge plan, including method of covering manhole opening and securing manhole from the public.
16. Method of protecting discharge manholes or structures from erosion and damage.
17. Thrust and restraint block sizes and locations.
18. Any temporary pipe supports, and anchoring required.
19. Alarm/alerting plan and contact information.
20. Schedule for installation of and maintenance of bypass pumping lines.

PART 2 - P R O D U C T S

2.1 EQUIPMENT AND MATERIALS

A. The pump and bypass pumping lines shall be of adequate capacity and size to handle the peak wet weather flow conditions. All piping, joints, and accessories shall be designed to withstand at least twice the max system pressure, or a minimum of 50 psi, whichever is greater.

B. Internal and/or external bypass pumping operations shall use 100% leak-proof pipe approved for wastewater use with restrained joints.

C. Pumps shall be fully automatic and solids handling, self-priming or submersible pumps in good working order with a working pressure gauge on the discharge. Self-priming pumps shall not require the use of foot-valves or vacuum pumps in the priming system. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows. The Contractor shall provide the necessary start/stop controls for each pump. A backup pump of the same capacity as the primary pump shall be always maintained on site to be used if the primary pump fails.

D. No wastewater shall be allowed to drain or stand in earthen sump pits.

E. Pumping between the hours 9:00 p.m. to 8:00 a.m. shall use sound attenuated pumps as the primary pumps. The back-up pump does not have to be sound attenuated and may be used as the primary pump between the hours of 8:00 a.m. and 8:00 p.m. Sound attenuated pumps shall reduce noise generated by the equipment to a maximum of 70 dBA when measured 30 feet from the pump.

F. The Contractor shall be required to demonstrate that the pumping system is in

good working order and is sufficiently sized to successfully handle flows by performing a test run for a period of 24 hours prior to beginning the Work.

G. Any wastewater back-ups and/or overflows as the result of inadequate equipment are the responsibility of the Contractor.

H. The Contractor shall be required to have all materials, equipment, and labor necessary to complete the repair or replacement on the job site prior to isolating the wastewater manhole and beginning bypass pumping operations.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

A. Maintain sewage flow to prevent backup or overflow onto streets, yards and unpaved areas or into buildings, adjacent ditches, storm sewers, and waterways. The Contractor shall take all necessary steps to prevent flooding of public or private property. Maintaining flow inside the existing pipe during rehabilitation operations is preferred.

B. It is the sole responsibility of the Contractor to locate and identify all existing sewer lines and services and to provide any and all labor, material, equipment, techniques, and methods to bypass pump as necessary for his construction methods and to monitor the effectiveness of this installed system and its effect on adjacent facilities.

C. The Contractor is responsible for implementing an alert system that will call or signal the Contractor and Owner of pump failure or sewage overflow for the entire duration of bypass pumping operations (both working/daytime and off work/nighttime hours).

D. Temporary plugs used for bypass pumping shall be reinforced with secondary plugs if the primary plug is compromised. Plugs shall be redundantly tethered to ensure that they are not lost in the wastewater collector system. Deviations from these requirements will be reviewed by the Engineer. Plugs shall be properly maintained and fully operational during all bypass pumping activities. Contractor is responsible for retrieving any bypass pumping equipment, including temporary plugs that enter the wastewater system.

E. Contractor shall complete the Work as quickly as possible and satisfactorily pass all tests, inspections, and repair all deficiencies prior to discontinuing bypass pumping operations and returning flow to the sewer manhole or line segment.

F. The Contractor will monitor levels to ensure the system does not surcharge above allowable levels.

G. During bypass pumping, do not allow sewage to be leaked, dumped, or spilled in or onto any area outside of the existing sanitary sewer system.

H. In the event of accidental spill or overflow, immediately stop the discharge and take action to clean up and disinfect the spill. Promptly notify the Owner so that required reporting can be made to the Texas Commission on Environmental Quality (TCEQ) and the Environmental Protection Agency (EPA) by the Owner. In the event of accidental spill or overflow, the Contractor is responsible for any damages that may have occurred to public or private property including cleaning, disinfection, and other corrections to the satisfaction of the Engineer at no cost to the Owner.

I. Contractor shall not intentionally damage, alter, or remove portions of the existing sewer system structures for the purpose of installing a bypass pumping system without specific approval from the Engineer or Inspector. If a structure is damaged, it shall be reconstructed or replaced to the satisfaction of the Engineer at no additional cost to the Owner.

J. The Contractor shall be responsible for any and all damage that results directly or indirectly from the interference of storm water runoff to bypassing equipment, piping, and/or appurtenances.

K. When bypass pumping operations are complete, piping shall be drained into the sanitary sewer prior to disassembly, and all pumps and lines shall be flushed with clean water until all discharge is clear.

3.2 TRAFFIC CONSIDERATIONS

A. The Contractor shall locate bypass pump(s) and discharge lines in a manner that does not cause unnecessary or excessive interference with the use of streets, private driveways, and alleys. Traffic control shall be performed under the approval and/or specifications of the respective City, County or State directives.

B. Ingress and egress to adjacent properties shall be always maintained. Contractor shall provide ramps, steel plates or other methods over temporary surface piping to facilitate access to adjacent properties.

3.3 SCHEDULING

A. The Contractor shall report any bypass pumping activities not included in the submitted plan to the Engineer prior to proceeding with these activities.

B. The Contractor shall cease bypass pumping operations when directed by the Engineer.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT:

A. Unless shown on the Drawings or called out within these Specifications as a pay item, no separate payment will be made for the installation, operation, and maintenance of bypass pumping system for any lateral service work or mains less than or equal to 6-inches.

B. When included as a contract pay item, measurement for bypass pumping shall be on per calendar day basis. Bypass pumping set-up and operation for 8-inch and larger sanitary sewer main will be a contract pay item. The Contractor will not be paid for bypass pumping when pumps are not in operation.

4.2 PAYMENT:

A. The Work performed and materials are furnished as described by this item and measured under the “Measurement” subsection, will be paid at the unit price bid, when included as a contract pay item. Unit prices shall be full compensation for

furnishing all labor, equipment, time, materials, and incidentals necessary to complete the Work.

END OF SECTION

SECTION 03100

SANITARY SEWER MAIN

PART 1 - GENERAL

1.1 SCOPE

A. The work included in this section consists of furnishing all material, equipment, labor and performing all operations necessary for the installation, adjustment or replacement of sanitary sewer mains, and stubs of the size and type specified in the drawings and all applicable work such as excavating, bedding, jointing, backfilling materials, testing and all other accessories within the limits of work, as shown on the drawings and specified herein.

B. Where references are made to other standards or codes unless specific date references are indicated the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01240, Trench Excavation Safety

C. Section 01500, Concrete for Structures

D. Section 01600, Concrete Encasement, Cradles, Caps and Seals

E. Section 02670, Ductile Iron Fittings

F. Section 02680, Joint Restraints and Thrust Blocking

G. Section 03120, Sanitary Service Laterals

H. Section 03220, Bulkheads

I. Section 03400, Sanitary Sewer Main TV Inspection

J. Section 03410, Sanitary Sewer Testing

K. Section 04815, Concrete Encasement

1.3 REFERENCE STANDARDS

A. Texas Commission of Environmental Quality (TCEQ)

1. Chapter 217 – Design for Domestic Wastewater Systems

2. Chapter 213 – Edwards Aquifer

B. Comply with the current American Water Works Association (AWWA) standards for materials relating to water distribution systems.

1.4 SUBMITTALS

A. Shop Drawings

1. Submit manufacturer’s product data, instructions, recommendations, and certificate of conformance with referenced standards. Indicate sizes and types to be installed.
2. Submit proposed methods, equipment, material, and sequence of operation for sewer construction.
3. Submit manufacturer’s specifications for the tracer wire. Indicate size and print legend to be installed.
4. Submit manufacturer’s specifications for the detectable marker tape. Indicate size and color code to be installed.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Pipe shall be unloaded and inspected in accordance with the manufacturer's instructions. Inspect each shipment of pipe and fittings and make provision for a timely replacement of any damaged material.

B. Pipe stored on the site shall be stored in the protective unit packages provided by the manufacturer. If packages need to be opened, the pipe shall be stored on a flat surface and not in direct contact with the ground. Do not stack higher than four (4) feet. Keep inside of pipe and fittings free from dirt and debris. Care shall be exercised to avoid compression damage or deformation to the pipe.

C. All pipe that are stored shall be covered to provide protection from the sunlight. Provide for air circulation through the stockpile.

D. Always handle all material carefully. Unload by hand or use canvas slings to avoid scratching the pipe. Do not slide or drag PVC pipe over an abrasive surface. Pipe with deep scratches shall be replaced with new pipe and removed from the site. Any pipe or fitting having a crack, or which has received a severe blow shall be marked rejected and immediately be removed from the work.

PART 2 – PRODUCTS

2.1 POLYVINYLCHLORIDE (PVC) SEWER MAIN (GRAVITY)

A. Materials

1. All gravity sewer main shall be PVC DR 26 unless stated otherwise on the Drawings.
2. All sanitary sewer PVC pipe shall be green. White pipe is prohibited.
3. For pipe sizes 4-inch to 15-inch in diameter: ASTM D3034, PSM diameter standard, DR 26 is required.
4. For pipe sizes 18-inch and larger: ASTM F679, PSM diameter standard, class PS 115 is required.

2.2 PRESSURE PIPE/FORCE MAINS

A. All wastewater pressure pipe shall be constructed of the following pipe materials:

1. Polyvinyl Chloride (PVC) pipe shall meet AWWA C900 standard having

Cast Iron Pipe size outside diameters and be pressure rated at 305 psi (DR-14) or 235 psi (DR-18) as indicated. All sanitary sewer PVC pipe shall be green. White pipe is prohibited. Each joint of pipe shall consist of single continuous extrusion; bells or other components attached by solvent welding are not acceptable. Pipe shall have push-on, rubber gasket joints of the bell and spigot type with thickened integral bells with rubber gasket joints. The wall thickness of each pipe bell and joint coupling must be greater than the standard pipe barrel thickness. Concrete thrust blocking shall be placed behind every bend and tee. All fittings shall be in conformance with AWWA C110 or C153 and be restrained per Specification Section 02680.

2. D2241 PVC Pressure Class 200 (SDR 21) for pipe 12-inch size and smaller. All sanitary sewer PVC pipe shall be green. White pipe is prohibited.

3. PE4710 HDPE DR-9 with a minimum diameter of four (4) inches,

4. Ductile iron pipe with pressure class 250 minimum for pipe greater than 12-inch size, and ductile iron pipe pressure class 350 for pipe 12-inch size and smaller. Ductile iron wastewater pipe shall be in accordance with AWWA C151 and shall have a corrosion resistant interior lining acceptable to the Owner. Lining to be used shall be shown on submittal.

2.3 PIPE MARKINGS

A. PVC sewer main permanent markings shall include the following at intervals of not more than five (5) feet:

a. Manufacturer’s name or trademark

b. Nominal pipe size

c. PVC cell classification per ASTM D1734

2.4 STANDARDS

A. Any PVC sewer mains having a deflection of the inside diameter greater than 5% after 30 days of installation will not be accepted.

B. All PVC sewer mains shall pass the low-pressure test, as described in 30 TAC § 217.57.

C. Reference Table C.1. in Figure: 30 TAC §217.53(d)(3) when a collection system pipe or manhole cannot be located at least nine feet away from a water supply pipe for protection requirements.

2.5 PIPE JOINT RESTRAINTS AND THRUST BLOCKING

A. Pipe joint restraints and thrust blocking shall conform to all requirements with all requirements of Section 02680 of these specifications.

2.6 DUCTILE IRON FITTINGS

A. All buried fittings shall be ductile iron with mechanical joints and shall conform to

all requirements within Section 02670 of these specifications.

2.7 PIPE TRACER WIRE

A. Tracer wire shall be installed on all non-ductile iron sewer main. Tracer wire shall be No. 12 AWG copper-clad steel, extra high-strength with minimum 1,150-lb break load and 30 mil HDPE insulation.

B. Tracer wire shall be taped or zip-tied to the main pipeline in a minimum of 60-inch increments.

C. A conductivity test shall be made on all wire installed. Tests and visual inspection shall be made at each valve box, meter box and listening port as applicable. Conductivity may be tested by using as electrical conductivity meter by attaching underground locating equipment and tracing the signal to each valve box and meter box. No acceptance or payment will be made on any section or reach of pipe installed that does not have a conductive electrical locator wire installed in accordance with the drawings.

2.2 MARKER TAPE

A. Marker tape shall be installed as an additional pipe identification device when pipe is installed by open trench method only.

B. During the backfilling process, all sanitary sewer mains and force mains, sewer service laterals and system appurtenances shall have a continuous warning tape placed immediately above them and throughout their length at a depth of eighteen (18) inches above the utility line surface. The tape shall be six (6) inches wide. Tape material shall be formulated from 100 percent virgin polyolefin resins. Resins shall be pigmental for chemical stability and resistance to sulfide staining (color fastness). Tape shall be constructed by the mechanical (non-adhesive) lamination of two piles of three layers blown film in such a manner as to produce a bi-axially oriented structure. The tape shall be able to provide a 700 percent elongation prior to rupture as per ASTM-D882.

C. The warning tape shall be manufactured with a permanent American Public Works Administration (APWA) green color pigment and at a max of every thirty (30) inches along its length, be imprinted with the applicable continuous warning message as follows:

1. CAUTION: BURIED FORCE MAIN BELOW
2. CAUTION: SANITARY SEWER LINE BELOW
3. CAUTION: SEWER LINE BELOW

2.8 PROHIBITED PIPE

A. The following pipe shall NOT be used:

1. Concrete pipe
2. Asbestos-cement (AC) pipe
3. Fiberglass reinforced sewer pipe (non-pressure type)

4. Concrete steel cylinder pipe

PART 3 – EXECUTION

3.1 SEWER MAIN INSTALLATION

A. The Contractor shall commence installation of the pipe at the downstream end of the sanitary sewer main. Pipe installation shall proceed upgrade (in an upstream direction) with the bell pointing in the upstream direction of flow.

B. No pipe shall be laid within 10 feet of any point where excavation is in progress.

C. Pipe shall be lowered into the trench without disturbing the prepared foundation or the trench sides.

D. The drilling of lifting holes in the field will not be permitted.

E. Pipe shall be installed by means of a concentric pressure being applied to the pipe with a mechanical pipe puller. Pulling or pushing a joint of pipe in pace using a crane, bulldozer or backhoe will not be permitted. Pipe shall be pulled in a straight line with all parts of the pipe online and grade at all times. No side movement of the pipe will be permitted during or after the pulling operation.

F. Should coupled joints of pipe be out of line or off grade, they shall be removed one joint at a time in the presence of the Inspector and brought to the proper line and grade. The lifting or moving of several joints of coupled pipe at one time to close a partially open joint or fine grade under laid joints of pipe will not be permitted.

G. No horizontal or vertical curves shall be permitted in conformance with appropriate regulatory agency requirements.

H. Before leaving the work unattended, the upper ends of all pipelines shall be securely closed with a tight-fitting plug or closure. The interior of laid pipe shall be kept free from dirt, silt, gravel, or foreign material at all times.

I. All pipes in place must be approved by the Inspector before backfilling.

J. When replacing an existing system in place, the Contractor shall maintain screens to prevent the entrance of construction debris into the sewer system.

K. Where not otherwise indicated, all sewer main shall be laid to the following minimum depths:

1. Sewer main installed in natural ground in easements or other undeveloped areas, which are not within existing or planned streets, roads, or other traffic areas shall be laid at least 36 inches of cover for wastewater service.

2. Sewer main installed in existing streets, roads, or other traffic areas shall be laid with at least 60 inches of cover.

3. Sewer main installed in such proposed streets shall be laid with at least 42 inches of cover below the actual subgrade.

3.2 PIPE SEPARATION

A. Where gravity and force main sewers are constructed in the vicinity of water mains, the requirements of the 30 TAC § 217.53 shall be met.

1. Collection system pipes must be installed in trenches separate from water supply trenches.

2. Wherever possible, a collection system pipe must be located below a water supply pipe. A sewer collection system pipe that parallels must have a vertical separation of at least (2) two feet between outside diameters of pipe or at least four (4) feet of horizontal separation.

3. Wherever possible, collection system pipes and manholes should be located at least (9) nine feet from all water supply pipes.

4. If a collection system pipe cannot be located below a water supply pipe; or, a collection system pipe or manhole cannot be located at least (9) nine feet from all water supply pipes, refer to Figure 30 TAC §217.53(d)(3) for design criteria and protection requirements.

5. A sewer collection system pipe that crosses a public water supply pipe or parallels a water supply pipe within (9) nine feet shall be constructed per the following:

    a. DR 18 (150 PSI) per AWWA C900 for PVC pipe smaller than 12-inch diameter

    b. DR 25 (165 PSI) per AWWA C905 for PVC pipe larger than 12-inch diameter

3.3 TEMPORARY PIPE PLUGS, CAPS, BULKHEADS AND TREANCH CAPS

A. Temporary plugs, caps, or plywood bulkheads shall be installed to close all openings of the pipe and fittings when pipe construction is not in progress.

B. All temporary end plugs or caps shall conform to all requirements within Section 03220 of these Specifications.

C. Trench caps shall be reinforced Class D concrete as indicated.

3.4 CONCRETE ENCASEMENT, CRADLES, CAPS, AND SEALS

A. When trench foundation is excessively wet or unstable or installation of water or wastewater pipe will result in less than 36 inches of cover, Contractor shall notify Engineer and Owner. The Engineer and Owner may require the Contractor to install a concrete seal, cradle, cap, encasement, or other appropriate action.

B. All concrete cap, etc., shall be continuous and begin and end within 6 inches of pipe joints. Concrete caps, cradles, and encasement shall conform to Section 01600 of these Specifications. The pipe shall be well secured to prevent shifting or flotation while the concrete is being placed.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot for each size diameter, types, and classes of main. Parallel lines will be measured individually. Where a main ties into an existing system, the length of the new main will be measured from the visible end of the existing system at the completed joint. Unless otherwise indicated, the length of sanitary sewer mains will be measured along main

horizontal centerline stationing through manholes, junctions, and other appurtenances.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing, installing, adjustment or replacement of sanitary sewer mains, and stubs, of the size and type specified by the open cut method regardless of trench depth as per the drawings and specified within. This item shall also include, but not necessarily be limited to all types and sizes of main; tracer wire; marker tape; bulkheads; elected embedment; compaction; sanitary sewer testing; excavation and backfill; trench excavation safety; and vertical stacks on deep sewer main services.

END OF SECTION

SECTION 03120
SEWER SERVICE LATERALS

PART 1 – GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, supervision, tools, equipment, materials, and requirements for sewer service laterals to the sanitary sewer mains.

B. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard code shall govern.

1.2 DESCRIPTION OF REQUIREMENTS

A. The Contractor shall furnish and install single service laterals in accordance with DTL #302 standard detail shown within the Drawings.

1.3 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01240, Trench Excavation Safety

C. Section 01500, Concrete for Structures

D. Section 02670, Ductile Iron Fittings

E. Section 03100, Sanitary Sewer Mains

F. Section 03200, Sanitary Sewer Manholes

G. Section 03410, Sanitary Sewer Testing

1.4 REFERENCED STANDARDS

A. American Society for Testing and Materials (ASTM) International

1.5 SUBMITTALS

A. Submit materials required to establish compliance with these Specifications. Submittals shall include the following:

1. Certified drawings showing all important details of construction and dimensions.

2. Descriptive literature, bulletins and/or catalogs of the equipment.

3. The total weight of each item.

4. Additional submittal data, where noted with individual pieces of equipment.

PART 2 – PRODUCTS

2.1 SERVICE CONNECTIONS

A. Service connections shall be installed at the locations designated by the Owner and in conformity to the same ditching and bedding detail as used on the main sewer line construction.

B. The minimum diameter of service connections to main sewer lines shall be 6-inch.

C. Service lines larger than 6-inch shall be connected to manholes.

D. Service pipe installed as part of main sewer line construction shall be 6-inch Polyvinyl Chloride (PVC) SDR 26 pipe which complies with the same requirements as the main sewer, conforming to ASTM D3034 with gasketed joints and all required markings consistent with main line material. When minimum separation requirements cannot be met, protection requirements shall be per Table C.1. in Figure: 30 TAC §217.53(d)(3).

E. Service pipe installed by a plumber in conjunction with a main line tap, existing stub out or manhole shall be either 6-inch ductile iron, SCH 40 PVC, or PVC pipe consistent with the existing stub out pipe.

2.2 FITTINGS

A. Wyes shall be 8-inch, 10-inch, 12-inch, etc., by 6 inches of the same material as the main line pipe and shall have the same type gasketed connections.

B. Bends shall be standard 6-inch, 11.25° (1/8) pipe bends. Bends and joints shall be as specified for service pipe.

PART 3 – EXECUTION

3.1 INSTALLATION OF SERVICE LINES ON NEW SEWER CONSTRUCTION:

A. Service connections shall be properly installed at the required locations. All wyes, bends, sanitary sewer main and other appurtenances shall be provided as required for each connection. All joints shall be installed to provide watertight connections.

B. Catalog cuts and related data for all material shall be submitted to the Owner and the Engineer for review.

C. Wye joints shall be installed as directed, with the branch turned to the proper direction, or as shown on the plans. Wyes shall be firmly supported by methods and materials used for bedding of main line pipe. Branch of wyes shall be installed at an angle 45° to the springline unless grade requirements dictate otherwise

D. Bends for service lines shall be placed in the wyes per the Drawings, or where necessary for proper alignment.

E. When installed during sewer line construction, service pipe shall be installed to the proper line and grade from the sewer line to the property line at a grade of not less than 1/4" per foot. Backfilling and bedding procedures shall be as for sewer mains. Watertight plugs shall be placed in the end of service line stubs. Plugs shall be as recommended by the pipe manufacturer and shall be installed in accordance with the Manufacturer's recommendation. Suitable markers shall be installed at the ends

of service line stubs for above ground location. A suitable marker shall include a section of pipe of the same material as service line extended one to two feet above ground surface.

1. Service line stub locations at the property line shall be recorded by the Contractor and furnished to the Engineer to be included on the as-built Drawings.
2. Service line locations shall be referenced to the station location of the main at the point the service line intersects the sewer main. In the event a service line is not installed at a 90° angle to the sewer main, the station of the service line at the property line shall be referenced to the main line station. The information shall also include the perpendicular distance from the center of the sewer main to the end of the service line and the depth of the sewer line.
3. The service line location data referenced in item 2 above shall be included on the as-built Drawings.

3.2 SERVICE CONNECTIONS TO EXISTING LINES:

A. Materials:

1. Minimum pipe size for new connections to either existing sewer main lines or manholes shall be 6 inches.
2. All sanitary sewer PVC pipe shall be **green**. White pipe is prohibited.
3. Taps into existing sewer main lines shall use a gasketed fitting in conjunction with a "Predco Fastfit" sewer tap saddle or ROMAC CB Sewer Saddle or approved equal. Saddles shall be mounted on pipe according to Manufacturer's recommendations.
4. Taps directly into manholes shall be made by coring the manhole wall and installing the proper size manhole boot.

B. Installation:

1. Taps will not be made prior to applicable fees being paid and a sewer connection permit being obtained from the Owner.
2. The main line will be tapped only when no service line stub is available. In the event the service line stub cannot be located by the Owner personnel, the plumber/ contractor will be allowed to tap the line. Service line shall be installed at an angle of 45° to the springline unless grade requirements dictate otherwise.
3. Ties to Existing Service Line Stubs:
    a. Connection shall be made with the proper watertight connector suitable for the application.
    b. Connection shall remain visible until inspection by the Owner and/or Engineer.
    c. Backfill shall be carefully placed and tamped around the connection as to prevent any settlement or movement.
4. Taps to Sewer Main Lines:

a. Tap saddles shall be installed in accordance with Manufacturer's recommendations.

b. Holes for saddles shall be 4.5 inches in diameter and shall be made by mechanical hole cutters or by keyhole saw or saber saw only. “Hammer Taps” are not approved. Holes shall be laid out with a template at an angle of 45° to the vertical (unless grade requirements dictate otherwise) and shall be deburred and carefully beveled to provide a smooth hole shaped to conform to the fitting. Care shall be taken to prevent any foreign material from entering the cut-in pipe opening. Any material or debris that does enter the line shall be removed.

c. Where applicable, saddle and pipe mating surfaces shall be wiped clean and dry. Epoxy cement shall be used in cementing in accordance with the cement manufacturer's recommendations and ASTM D2855.

d. Service line shall be connected to the Predco tap saddle or Romac CD saddle by means of a fixture specified by the tap saddle Manufacturer.

e. Tap inspections shall be conducted after hole is cut, but before connection is made up.

f. If integrity of sewer main is breached during tap installation:

i. Where the installation of the tap causes visible cracks or splits in the clay sewer line, the sewer main line will be encased in concrete for the full length of the cracked pipe.

ii. Where the installation of the tap causes visible cracks or splits in the PVC sewer line, the cracked sewer line shall be cut out and replaced with a section of the appropriate size SDR-35 PVC using gasketed, PVC, bell x bell or bell x spigot couplings or approved equal watertight coupling suitable for the application. The EFT shall determine the length of damaged sewer main to be replaced to remove all damaged material. The EFT, at their discretion, may approve “Fernco” or similar rubber, strapped, couplings in making PVC or DIP main-sewer pipe connections.

iii. Any sewer line damaged during the installation of a tap, shall be repaired at no cost to the Owner.

g. In the event water is entering into the ditch, the contractor/plumber shall pump the ditch as dry as necessary to make the complete connection visible at the time of inspection.

h. Backfill shall be carefully placed and tamped around the connection so as to prevent any settlement or movement. Where a cracked pipe is encased in concrete, backfilling shall not commence until the encasement has hardened.

5. Taps to Manholes:

a. Service line must enter manhole at angle no less than 90° to the

direction of flow.

b. For manholes less than 12 feet in depth:

i. Plumber/contractor shall core drill the manhole wall directly above manhole table to a diameter specified by the manhole boot manufacturer. If the slope of table is less than 2 1/2" per foot, the invert of service line shall enter manhole 6" above table, and a suitable service invert formed on the table.

ii. Pipe connections shall be made by a flexible synthetic rubber boot mechanically clamped to the manhole and to the pipe to provide a watertight seal and designed to accommodate pipe movement up to 2 inches radically or 22 degrees angularly in any direction. The synthetic rubber boot shall have a minimum wall thickness of 3/8 inch. The synthetic rubber material shall conform to ASTM C-923. Bands, clamps and other metal accessories shall be of Series 304 stainless steel. Approved manhole boots shall be Kor-N-Seal as Manufactured by NPC or PSX Direct Drive as manufactured by Press-Seal or equal.

iii. The void area inside the manhole boot shall be filled with non-shrink grout such as "Preco Plug" or approved equivalent, and walls shall be troweled smooth.

iv. A curved trough shall be formed on/in manhole table to direct flow into the main invert. If the service enters below the table, then table must be removed, and a new trough formed.

v. Tap inspections shall be held before backfilling commences. Work must be visible and dewatered during inspection.

vi. Backfill shall be carefully placed and tamped around the connection so as to prevent any settlement or movement and shall commence only after non-shrink grout has sufficiently hardened.

c. For manholes greater than 13.5 feet in depth, an inside drop may be installed. Inside drops on existing (4-foot inside diameter) manholes are allowed for 6” services; however, it is critical that the drop be constructed so as minimize the intrusion into the manhole. Also, no restriction of the normal use of the manhole steps is allowed.

i. Plumber/contractor shall core drill the manhole wall a minimum of four feet below ground surface. If four feet cannot be obtained, notify the Owner and Engineer before proceeding.

ii. A manhole boot shall be installed as given in paragraph 5.b above.

iii. Service pipe shall be inserted through the manhole wall.

iv. A tee shall be placed on pipe with run horizontal for clean out, and a PVC plug, with a section removed, inserted in the run of the tee. The half-plug will create a dam prevent high

flows from overrunning the drop but will permit the entry of rodding tools for cleaning.

v. The drop pipe shall extend to the manhole table and a 45° bend shall be installed on the end. The 45° bend shall be rotated toward the direction of water flow in the invert.

vi. Inside piping shall be secured to the manhole wall by means a stainless-steel strap spaced every 4 vertical feet and securely anchored to manhole wall. The space between the entering pipe and the manhole opening shall be sealed with a non-shrink grout.

vii. A curved trough shall be formed on/in manhole table to direct flow into main invert. The trough shall extend beyond the opening of the 45° bend to its curvature or change in direction.

viii. The void area inside the manhole boot shall be filled with non-shrink grout such as "Preco Plug" or approved equivalent, and the walls shall be troweled smooth.

ix. Tap inspection shall be held before backfilling commences. Work must be visible and dewatered.

x. Backfill shall be carefully placed and tamped around the connection so as to prevent any settlement or movement only after non-shrink grout has sufficiently hardened.

xi. The Owner reserves the right to deny the installation of an inside drop for any reason. If an inside drop is planned, the plumber should contact the Engineer to confirm approval prior to proceeding with the work.

C. Inspection of Taps to Existing Sewer Main Lines:

1. Plumber shall contact the Owner approximately eight hours before tap inspection will be needed. Tap to main lines shall remain unconnected and dewatered until the tap has been approved by the Owner and/or Engineer.

2. In the event a road or street must be cut in order to make the connection, the plumber will obtain any and all permits to conduct work in public right of way; and have it at the job site at the time of the inspection.

3. Service lines over 100 feet in length shall be tested for infiltration and exfiltration per Section 03410 of these Specifications.

4. If tap fails inspection, the connection will be corrected at no expense to the Owner. Another inspection is required after correction and tap shall remain uncovered and dewatered until tap passes inspection.

6. Failed Inspections:

a. Any tap which fails inspection shall be corrected within 5 working days, after the date on which the first inspection was performed.

b. The Owner and Engineer shall be notified of any tap which is not corrected and successfully re-inspected within this time frame.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Sewer service laterals shall be measured by each unit installed at the various diameter sizes and type of material.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing and installing sewer service laterals by the unit of various diameter sizes by open cut method regardless of trench depth as per the Drawings. This item shall include, but not necessarily be limited to all materials including pipe; pipe fittings (to include wyes, tees, bends, and other appurtenances); gaskets; bypass pumping; excavation and backfill; trench excavation safety; surface restoration; testing; cutting pavement; concrete support and all other work incidental to the installation of sewer service laterals.

END OF SECTION

SECTION 03200

SANITARY SEWER MANHOLES

PART 1 – GENERAL

1.1 SCOPE

A. The work included in this section consist of furnishing all material, equipment, labor and performing all operations necessary for the installation, adjustment or replacement of sanitary sewer manholes including protective coating, excavation, installation, backfilling and surface restoration.

B. Where references are made to other standards or codes unless specific date references are indicated the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01500, Concrete for Structures

C. Section 03100, Sanitary Sewer Main

D. Section 03210, Frames, Grates, Rings, and Covers

E. Section 03220, Bulkheads

F. Section 03400, Sewer TV Inspection

1.3 REFERENCE STANDARDS

A. Texas Commission on Environmental Quality (TCEQ)

1. Chapter 213 – Edwards Aquifer

2. Chapter 217 – Design Criteria for Domestic Wastewater Systems

B. American Society for Testing Materials (AASHTO)

1. M306: Standard Specification for Drainage, Sewer, Utility, and Related Castings

C. American Society of Engineers (ASME)

1. ASME B 16.1 – Cast Iron Pipe Flanges and Flanged Fittings

D. American Society for Testing and Materials (ASTM)

1. A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile

2. A 536: Standard Specification for Ductile Iron Castings

3. A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

4. C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

5. C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections
6. C 890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
7. C 913 – Standard Specifications for Precast Concrete Water and Wastewater Structures
8. C 923 – Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
9. C 990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
10. D 638 - Test Method for Tensile Properties of Plastics
11. D 648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edgewise Position.
12. D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft.)
13. D 790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
14. D 1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
15. D 1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique
16. D 1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
17. D 2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
18. D 4787 - Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
19. D 7234 - Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers

E. National Association of Corrosion Engineers (NACE)

1. SPO 188 - Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

1.4 SUBMITTALS

The submittal requirements of this specification item include:

A. Type, size, and manufacturer of manhole (diameter of water or wastewater manhole), structure (precast, cast in place, standard, Tee, etc.), and materials and equipment to be furnished (concrete, seals, rings, covers, etc.)

B. Aggregate types, gradations, and physical characteristics for the Portland cement concrete mix.

C. Proposed proportioning of materials for the mortar mix.

D. Proposed product for coating the interior surface of new and/or existing wastewater manholes.

E. Submit the following procedures.

1. Acceptance testing procedure
2. Associated test equipment and materials type structures
3. Adjustment technique

F. Submit test record reports to include as a minimum of the following items:

1. Name of manhole Manufacturer
2. Interior surface coating type and application method for wastewater manholes
3. Protective coating test reports
4. Model and Manufacturer of vacuum tester
5. Test method used.
6. Date tested and re-tested
7. Passed or fail. If failed, describe what was done to correct the problem.
8. Location and station of manhole
9. Precast and cast-in place bottom
10. Description of repairs made to joints, if any.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All items shall be unloaded and inspected in accordance with the manufacturer's instructions. Inspect each manhole segment and make provision for a timely replacement of any damaged material.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Concrete and Cement Stabilizing Sand

1. All concrete shall be provided in accordance with Section 01500, Concrete for Structures of these Specifications.
2. The cast in place concrete shall be Class A. The precast concrete manhole base section, riser section, and appurtenances shall conform to the applicable requirements of ASTM C 478.
3. Concrete for backfill of over-excavated areas shall be Class A or Class J as indicated in the drawings.
4. Cement stabilized sand for bedding or backfilling shall contain two bags of Portland Cement per cubic yard.

5. The sand shall meet the requirements for fine aggregate in accordance with Section 01500 of these Project Specifications.

B. Mortar

1. The mortar shall be composed of one part Portland cement, one part masonry cement (or 1/4 part hydrated lime), and sand equal to 2-1/2 to 3 times the sum of the volumes of the cements and lime used. The sand shall meet the requirements for "Fine Aggregate" within Section 01500 of these Specifications.

C. Reinforcement Steel

1. The reinforcement steel shall be provided in accordance with Section 01500 of these Project Specifications. Secondary, non-structural steel in cast-in-place wastewater manholes may be replaced by collated fibrillated polypropylene fibers, if approved by the Engineer and Owner.

D. Pre-Cast Concrete Manhole Components

1. All constructed manholes shall be watertight and equipped with pre-tested and approved rings and covers. New manholes shall conform to the applicable requirements of ASTM C 478.

2. Precast Base Sections, Riser Sections, and Cones

a. The width of the invert shall be specifically sized for the connecting sewer mains. Inverts shall be “U” shaped with a minimum depth of three fourths of the largest main diameter. Where sewer mains enter the manhole up to 24 inches above the flowline of the outlet, the invert shall be filleted to prevent splashing and solid deposition. A drop sewer main shall be provided for a sewer entering a manhole at more than 24 inches above the flowline of the outlet.

b. Joints for concrete base sections, riser sections, and cones shall conform to the requirements of ASTM C 443. Precast bases for 78 inches inside diameter manholes shall have performed inverts. Inserts acceptable to the Engineer shall be embedded in the concrete wall of the manhole sections to facilitate handling; however, through-wall holes for lifting shall not be permitted. Any voids between the sewer main and boot shall be filled with a product recommended by the manhole Manufacturer to prevent solids collection.

3. Precast Junction Boxes

a. Precast junction boxes shall be allowed only where indicated on the Drawings or acceptable to the Engineer. Joints for wastewater junction boxes shall conform to the requirements of ASTM C 443.

b. Precast bases and precast junction boxes shall have flexible, resilient and noncorrosive boot connectors or ring water stops acceptable to the Engineer conforming to the requirements of ASTM C 923 on all wastewater pipe connections.

4. Precast Grade Rings

a. Rings shall be reinforced Class A or I concrete.

b. Precast grade rings at 24 ½ inches inside diameter

i. The adjustment ring shall be used only for adjusting manholes with 24-inch lids. Inside to outside diameter dimension of the ring shall be 6 inches with a thickness of 3 inches to 6 inches.

c. Precast grade rings at 35 inches inside diameter

i. The adjustment ring shall be used for all new manhole construction with 32-inch lids. Inside to outside diameter dimension of the ring shall be 6 inches with a thickness of 4 inches to 6 inches.

E. New Manhole Construction and Minor Manhole Adjustment:

1. New manhole construction and minor manhole adjustments shall be performed in accordance with the Typical New Manhole Construction and Minor Manhole Adjustment Detail (DTL#322) as per the Drawings and shall consist of adding precast reinforced concrete rings to adjust the manhole to final grade.

2. For new manhole construction, the maximum vertical allowable ring adjustment, including the depth of the ring casting, shall be limited to 18 inches.

3. For adjustments of existing manholes that fall within the limits of overlay and street reconstruction projects, the maximum vertical allowable, including the depth of the ring casting, shall be limited to two feet.

4. All other existing manholes shall have a maximum allowable ring adjustment, including the depth of the ring casting, of one foot.

5. Any adjustment that will exceed these requirements shall be accomplished in accordance with the Typical Major Manhole Adjustment Detail (DTL #321) and as described below in subsection (H). All manholes not located in paved areas shall have bolted covers.

F. Interior Surface Coating for Wastewater Manholes: The interior surface of new manholes should be properly prepared prior to product application in accordance with NACE No.6/SSPC-SP13. Interior surfaces shall be coated with one of the following products per the manufacturers recommended installation thickness:

1. Stand Alone Coating: Kerneos - SewperCoat 2000 HS & PG.

2. Raven - 405 Series High Build Epoxy Liner

G. Manhole Rings and Covers: Rings and covers shall be provided in accordance with Section 03210 of these Project Specifications.

H. I&I Barrier: Provide submittal for approval on I/I barrier.

I. Bulkheads: Bulkheads shall be provided in accordance with Section 03220 of these Project Specifications.

J. Waterproofing joint materials: O-rings and wedge seals for the joints of all wastewater manholes shall conform with ASTM C 443. The connections between reinforced concrete wastewater manhole structures and sewer mains shall meet the requirements for ASTM C 923.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manholes shall be constructed at such places as shown in the contract documents or as designated by the Engineer, and in conformity with the typical details. The Inspector will inspect all sewer mains before it is placed in the trench and will reject any sections found to be damaged or defective to a degree that would affect the structural integrity of the sewer main. Rejected sewer main shall be immediately removed from the site and replaced with new acceptable sewer main.

B. Contractor shall insure that all existing or proposed manholes or structures shall always remain visible and accessible. No manhole or structure covers shall be covered by pavement, equipment, or other obstructions other than removable, temporary lid provided for safety. Inspector shall cause work to be suspended until this requirement is met without any valid claims of costs or schedule delays.

C. All manholes shall have a minimum inside diameter of 48 inches. Manhole base section or junction box dimension shall be appropriately increased to accommodate all converging sewer main. A minimum horizontal clearance of 12 inches shall be maintained between adjacent sewer mains. Sewer main ends within the base section or junction box walls shall not be relied upon to support overlying manhole dead and live load weights. All wastewater branch connections to new or existing mains shall be made at manholes with the influent main crown installed at the elevation of the effluent main crown. Where lines enter the manhole up to 24 inches above the flowline of the outlet, the invert shall be sloped upward to receive the flow, thus preventing splashing or solids deposition. Where the spring line of an influent main is 24 inches or more above the spring line of the effluent main, a drop manhole shall be used. Construction of extensions to existing systems shall require placement of bulkheads at locations indicated or directed by the Engineer or Owner. Unless otherwise indicated on the Drawings; wastewater manholes shall have concentric cones, except on manholes over large mains where an eccentric cone shall be situated to provide access to an invert ledge. Eccentric cones may be used where conflicts with other utilities dictate. Flat-slab tops may be used where clearance problems exist.

D. Manholes shall be founded at the established elevations on uniformly stable subgrade. Unstable subgrade shall be over-excavated a minimum of 12 inches and replaced with a material acceptable to the Engineer and/or Owner. Precast base units shall be founded and leveled on a 6-inch coarse aggregate bedding. A sewer main section with a prefabricated tee manhole and half the length of the adjoining sewer main sections on each side shall be founded on a minimum of 6-inch unreinforced Class A concrete. The cast-in-place concrete cradle shall be placed against undisturbed trench walls up to the sewer main’s spring line.

E. All adjustments shall be completed prior to the placement of the final surface.

F. Manhole components to be reused shall be carefully removed and the contact areas shall be cleaned of all mortar, concrete, grease and sealing compounds. Any items broken in the process of removal and cleaning shall be replaced in kind by the Contractor at its expense.

G. If the adjustment involves lowering the top of a manhole, a sufficient depth of

precast concrete rings or brick courses shall be removed to permit reconstruction. The mortar shall be cleaned from the top surface remaining in place and from all brick or concrete rings to be reused and the manhole rebuilt to the required elevation. The manhole ring and cover shall then be installed with the top surface conforming to the proposed grade.

H. If the adjustment involves raising the elevation of the top of the manhole in accordance with section 2.1.G, the top of brick or concrete ring shall be cleaned and built up vertically to the new elevation, using new or salvaged concrete rings and the ring and cover installed with the top surface conforming to the proposed grade.

I. Cast-in-place foundations shall have a minimum depth of 12 inches at the invert flowline. The widths of all manhole inverts shall be specifically sized for the connecting sewer mains. Inverts shall be “U” shaped with a minimum depth of three fourths of the largest sewer main diameter. The lowermost riser section may be set in the Portland cement concrete, while still green, after which the foundation shall be cured a minimum of 24 hours prior to proceeding with construction of the manhole up to 12 feet in depth. The foundation shall be cured an additional 24 hours prior to continuing construction above the 12-foot level. Manhole depth shall be measured from the invert flowline to the finish surface elevation.

J. Wastewater manholes having cast in place foundations may be constructed over existing sewer mains, except polyvinyl chloride (PVC), and the top half of the sewer main removed to facilitate invert construction. The manhole bottom shall rise from the spring line elevation of the sewer main, approximately one inch for each 12 inches of run (1:12,8%). Wastewater manholes with lines larger than 18 inches shall require precast bases; manholes constructed over in-service mains, however, may be built on cast-in-place foundations if the flow cannot be interrupted. Precast and cast-in-place wastewater junction boxes shall be allowed only were indicated on the Drawings.

K. Sewer mains, except reinforced concrete mains, set in cast-in-place foundations, shall require a water stop seal or gasket around the outside perimeter of the main. It shall be approximately centered under the manhole section wall.

L. Cast-in-place wastewater manholes, junction boxes and flat-slab transitions shall be reinforced, Class A concrete in accordance with Section 01500, Concrete for Structures, of these Project Specifications. Forms will be required for all cast-in-place walls above the foundation. Where the surrounding material can be trimmed to a smooth vertical face, outside forms may be omitted.

M. Backfilling for manholes shall conform to the density requirements of Section 01230, Excavation and Backfill. Manhole construction in roadways may be staged to facilitate base construction. Manholes constructed to interim elevations shall be covered with steel plates of sufficient thickness to support vehicular traffic. Steel plates on wastewater manholes shall be set in mortar to minimize inflow. Manholes shall be completed to finish elevation prior to placement of the roadway's finish surface. The excavation for completion of manhole construction shall be backfilled with flowable fill using 2 sacks of cement per cubic yard up to the bottom of the Portland Cement pavement slabs or to within 2 inches of finish elevation of asphaltic concrete pavements. The flowable fill shall be a minimum of 12 inches thick around the entire perimeter of the manhole.

N. After rings and covers are set to grade, the inside and outside of the concrete rings shall be wiped with mortar so placed as to form a durable water-tight joint smooth and even with the manhole cone section. No grouting shall be performed when the atmospheric temperature is at or below 40°F (5°C), and when necessary, because of a sudden drop in temperature, joints shall be protected against freezing for at least 24 hours.

O. When applying manhole protective coating, surface is to be prepped per NACE No.6/SSPC-SP13 with 125 mils of approved protective coating per the Manufacturer's instructions.

P. Joints on sewer pipes shall not be cast or constructed within the wall sections of manholes.

Q. Voids between exterior pipe walls and manhole walls at all pipe connections in manholes shall be filled with a non-shrink grout, concrete or mortar, as approved by the Engineer or as shown in the contract documents and inspected prior to backfilling.

R. Where connections to existing manholes are required, the adjacent pipe bedding shall be prepared to proper grade, the existing manhole neatly cut and the new pipe inserted so that the end is projecting 2 inches from the inside wall. The invert shall then be reshaped to properly channel new flows. Debris of any kind shall be kept out of new or existing manholes or mains.

S. Manhole Ring Encasement: All manhole rings shall be encased with 4,000 psi reinforced concrete as shown in the contract documents or as approved by the Engineer. Concrete manhole ring encasement shall extend 6 inches below the top of the cone and have a minimum width when measured at the manhole ring of 1 foot. The surface of the encasement shall be flush with the top of the manhole ring. Where manholes are constructed in existing streets and where directed by the Engineer or shown in the contract documents, the exterior exposed surfaces of the ring, mortar; throat rings and manhole surface shall be coated with a ⅛ inch minimum thickness of mastic or plastic prior to placement of concrete.

3.2 TESTING FOR WASTEWATER MANHOLES

Manholes shall be tested separately and independently of sanitary sewer mains. All new manholes must pass a leakage test. The contractor shall test each manhole (after assembly and backfilling) for leakage, separate and independent of all other sanitary sewer mains, by means of either a hydrostatic test, vacuum test, or other methods approved by the Engineer. The Contractor is hereby instructed to conduct either of the two identified tests in the following manner:

A. Vacuum Method: A vacuum test shall be performed by the Contractor prior to backfilling those manholes that fall within the right-of-way that require detouring of vehicular traffic. A second vacuum test will not be required after backfilling and compaction is complete unless there is evidence that the manhole has been damaged or disturbed subsequent to the initial vacuum test.

For manhole installations which do not require detouring of vehicular traffic, the vacuum method is recommended and may be used by the Contractor prior to backfilling the manhole to ensure proper installation so that defects may be located and repaired; however, a vacuum test shall be performed after backfilling, and

compaction are complete. Testing after backfilling and compaction are complete will be the basis for acceptance of the manhole.

1. Equipment:

   a. The manhole vacuum tester shall be a device approved for use by the Engineer and/or Owner.

   b. Pipe sealing plugs shall have a load resisting capacity equal to or greater than that required for the size of the connected pipe to be sealed.

2. Procedures for new installed 4'-0" diameter manholes

   a. Manhole section interiors shall be carefully inspected; units found to have through-wall lift holes, or any penetration of the interior surface by inserts provided to facilitate handling, will not be accepted. Coating shall be applied after the testing unless coating is applied before installation or unless it is applied at the factory. All lift holes and exterior joints shall be plugged with an acceptable non-shrink grout. No grout shall be placed in horizontal joints.

   b. After cleaning the interior surfaces of the manhole, the Contractor shall place and inflate pneumatic plugs in all the connecting pipes to isolate the manhole; sealing pressure within the plugs shall be as recommended by the plug manufacturer. Plugs and the ends of pipes connected by flexible boots shall be blocked to prevent their movement during the vacuum test.

   c. The vacuum test head shall be placed on the top of the cone section or, inside of the top of the manhole cone section, and the compression seal band inflated to the pressure recommended by its manufacturer. The vacuum pump shall be connected to the outlet port with the valve open. When a vacuum of 10 inches of mercury (-5 psig) has been attained, the valve shall be closed and the time noted. Tampering with the test equipment will not be allowed.

   d. The manhole shall have passed the test if the vacuum does not drop below 9 inches of mercury (-4.5 psig) within three (3) minutes of the time the valve was closed. The actual vacuum shall be recorded at the end of the three (3) minutes during which the valve was closed.

   e. When the standard vacuum test cannot be performed because of design or material constraints (examples: T-Type manholes, T-Lock Liners, or other reasons acceptable to the Engineer or designated representative), testing of individual joints shall be performed as directed by the Engineer or designated representative.

B. Exfiltration Method: At the discretion of the Engineer and/or the Owner, the Contractor may substitute the Exfiltration Method of testing for the Vacuum test described in Subsection 3.2.A above. This method may only be used when ground water is not present. If ground water is present a Vacuum Test shall be used unless otherwise directed by the Engineer and/or the Owner. All backfilling and compaction shall be completed prior to the commencement of testing. The

procedures for this test shall include the following:

1. Manhole section interiors shall be carefully inspected; units found to have through wall lift holes, or any penetration of the interior surface by inserts provided to facilitate handling, will not be accepted. Coating shall be applied after the testing unless coating is applied before field assembly, or at the factory. All lift holes and exterior joints shall be plugged with an acceptable non-shrink grout. No grout shall be placed in horizontal joints

2. After cleaning the interior surface of the manhole, the Contractor shall place and inflate pneumatic plugs in all of the connecting pipes to isolate the manhole; sealing pressure within the plugs shall be as recommended by the plug Manufacturer.

3. Concrete manholes shall be filled with water or otherwise thoroughly wetted for a period of 24 hours prior to testing.

4. At the start of the test, the manhole shall be filled to the top with water. The test time shall be 1 hour (60 minutes). The Construction Inspector must be present for observation during the entire time of the test. Permissible loss of water in the 1-hour test time is 0.025 gallons per diameter foot, per foot of manhole depth. For a 4-foot diameter manhole, this quantity converts to a maximum permissible drop in the water level (from the top of the manhole cone) of 0.05 inches per foot of manhole depth or 0.5 inches for a 10-foot-deep manhole.

C. Failure to Pass and Records: If the manhole fails to pass the initial test method as described in (A) Vacuum Method and, if allowed, (B) Exfiltration Method, or if visible groundwater leakage into the manhole is observed, the Contractor shall locate the leak, if necessary, by disassembly of the manhole. The Contractor shall check the gaskets and replace them if necessary. The Contractor may re-lubricate the joints and re-assemble the manhole, or the Contractor may install an acceptable exterior joint sealing product on all joints and then retest the manhole. If any manhole fails the vacuum and/or exfiltration test twice, the Contractor shall consider replacing that manhole. If the Contractor chooses to attempt to repair that manhole, the manhole must be retested until it passes. In no case shall cold applied preformed plastic gaskets be used for repair. Records of all manhole testing shall be made available to the Engineer and/or the Owner at the close of each working day, or as otherwise directed. Any damaged or visually defective products, or any products out of acceptable tolerance shall be removed from the site.

D. Protective Coating Testing:

1. Spark (Holiday)Test – After the coating product(s) have cured in accordance with manufacturer recommendations, all surfaces shall be inspected for holidays per NACE RPO188-99 or ASTM D4787 standards. All detected holidays shall be marked and repaired according to the coating product(s) Manufacturer’s recommendations.

    a. Test voltage shall be a minimum of 100 volts per mil of coating system thickness.

    b. Detection of a known or induced holiday in the coating product shall be confirmed to ensure proper operation of the test unit.

c. All areas repaired shall be retested following cure of the repair material(s).

2. Adhesion Test - Adhesion of the coating system to the substrate shall be confirmed in a minimum of 5% of the manholes coated (no fewer than 1 manhole). After the coating product(s) have cured in accordance with manufacturer recommendations, testing shall be conducted in accordance with ASTM D7234 standard. Owner's representative shall select the manholes and areas to be tested.

E. Inspection: The Engineer or designated representative shall make a visual inspection of each manhole after it has passed the testing requirements and is in its final condition. The inspection shall determine the completeness of the manhole; any defects shall be corrected to the satisfaction of Engineer or Owner.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT:

A. Sanitary sewer manholes will be measured by the unit of each completed junction box and manhole from zero feet to eight (8) feet in depth.

B. Sanitary sewer manholes and junction boxes deeper than eight (8) feet shall be measured by the number of vertical feet in excess to eight (8) feet.

4.2 PAYMENT:

A. Payment shall be full compensation for all labor, materials, equipment, materials, necessary for furnishing and installing completed new junction boxes and manholes as shown in the drawings and as specified herein. This item shall include, but not necessarily be limited to excavation and backfill, surface restoration, coating, cones, bases, rings and covers, manhole ring, manhole rubber joint seal, mortar, saws cutting of surfaces, testing, inspection, and all other work incidentals to furnishing and installing a completed junction box and manhole.

B. Payment for that portion of a Standard pre-cast manhole with pre-cast base, drop manhole with pre-cast base, special manhole, centered tee manhole, or tangent tee manhole in excess of eight (8) feet in depth will be made at the unit price of extra depth manholes paid for at the unit price bid per vertical foot of the indicated type and size complete in place.

END OF SECTION

SECTION 03210

FRAMES, GRATES, RINGS, AND COVERS

PART 1 - GENERAL

1.1 SCOPE

A. This item shall govern furnishing and installation of frames, grates, rings and covers for inlets, manholes and other structures indicated on the drawings.

1.2 RELATED SECTIONS

A. Section 01500, Concrete for Structures

1.3 REFERENCE STANDARDS

A. Current Texas Commission on Environmental Quality (TCEQ) rules and American Water Works Association (AWWA) standards relating to manholes and sewer collection systems.

1.4 SUBMITTALS

A. Shop Drawings

1. Submit manufacturer's drawings for material to be supplied under this Section. Indicate model number, description, model number, painting requirements, and characteristics of frames, grates, rings, covers, height adjustment insert, and nuts and bolts to be installed.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Welded Steel

1. Welded steel grates and frames shall conform to the number, size, dimensions, and details indicated on the drawings and shall be welded into an assembly in accordance with those details. Steel shall conform to the requirements of American Society for Testing and Materials (ASTM) A36/A36M.

B. Castings

1. Castings, whether Carbon-Steel, Gray Cast Iron or Ductile Iron shall conform to the shape and dimensions indicated on the drawings and shall be clean substantial castings, free from sand or blowholes or other defects. Surfaces of the castings shall be free from burnt on sand and shall be reasonably smooth. Runners, risers, fins, and other cast on pieces shall be removed from the castings and such areas ground smooth. Bearing surfaces between manhole rings and covers or grates and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact. Pairs of machined castings shall

be matchmarked to facilitate subsequent identification at installation except for water and wastewater manhole and valve castings. These manhole and valve castings shall be fabricated with such draft, tolerances, bolt hole spacing, etc., that all rings and covers of a particular type or class are interchangeable and matchmarking will not be required.

2. Steel castings shall conform to ASTM A27/A27M. Grade 70-36 (480-250) shall be furnished unless otherwise specified on the drawings.

3. Cast iron castings shall conform to ASTM A48.

4. Ductile Iron castings shall conform to ASTM A 536. Grade 60-40-18 (415-275-125) shall be used unless otherwise indicated on the Drawings.

C. Manhole Rings

1. Manhole rings shall be made of HDPE or precast concrete and have a maximum thickness of 2 inches.

2. The internal diameter shall match that of the manhole cover's opening.

3. A UV stabilized internal polyethylene liner shall be used in conjunction with manhole rings for the purpose of providing an infiltration/inflow (I/I) barrier.

D. Nuts and Bolts

1. Nuts and bolts shall be hex head 5/8" x 2.5" #11 National Coarse Thread, Type 316 stainless steel. For bolted manhole covers, a thin film of an approved "Anti-freeze" compound, approved by the Engineer or designated representative, shall be applied to all bolts.

E. Mortar

1. Unless otherwise specified or approved by the Engineer or designated representative, the mortar for bedding castings shall consist of one (1) part Portland cement and three (3) parts sand and sufficient water to provide the desired consistency. The gradation of the fine aggregate shall meet the requirements for Grade No. 1 per the requirements of Section 01500, Concrete for Structures.

PART 3 – CONSTRUCTION METHODS

3.1 Frames, grates, rings and covers shall be installed in accordance with the drawings and details.

3.2 All welding shall conform to the requirements of the ANSI/AWS Structural Welding Code D1.1. Welded frames, grates, rings and covers shall be given 1 coat of a commercial grade red lead oil paint and 2 coats of commercial grade aluminum paint. All coats shall be a minimum of 1.5 mils, dry.

3.3 Butyl rubber sealant or concrete grout shall be placed between each manhole ring to create an infiltration/inflow barrier.

3.4 A minimum of two and a maximum of six manhole rings may be used at each adjusted manhole.

3.5 Manhole rings are limited to a minimum of two and a maximum of four rings for new

manhole construction.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Unless shown on the construction plans or called out within the specifications as a pay item, frames, grates, rings and covers will not be measured. The quantities shown for these items or described are for informational purposes only.

4.2 PAYMENT: Unless specified as a pay item, frames, grates, rings and covers will not be paid for separately. Payment for furnishing all materials, tools, equipment, labor and incidentals to complete the Work will be included in the Bid Items which constitute the complete structures.

END OF SECTION

SECTION 03220

BULKHEADS

PART 1 - G E N E R A L

1.1 SCOPE

A. The Work in this Section consists of furnishing all labor, materials, equipment, and incidentals for installing plywood or end caps as a temporary utility plug as. This Work will be placed in conjunction with installation of a sewer main where a continuation of the system will be performed later as shown in the Drawings.

1.2 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01500, Concrete for Structures

C. Section 03100, Sanitary Sewer Main

1.3 SUBMITTALS

A. Provide Manufacturer's shop drawings and indicate material type (wood, plastic, rubber, etc.) f or the bulkheads.

B. Provide the bulkhead's application such as pipe characteristics and locations.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

PART 2 – P R O D U C T S

2.1 MATERIALS

A. Plywood shall be construction grade, ¾ inch thick and need not be new or treated.

B. End caps may be plastic, vitrified clay pipe, rubber, or concrete.

PART 3 – CONSTRUCTION METHODS

3.1 After installation of the utility requiring temporary bulkheading, an end cap or a section of plywood, having dimensions at least 6 inches more than the outside sewer main diameter shall be attached to the exposed bell or spigot and backfilled immediately after installation. Care shall be exercised to prevent the backfill material from entering the sewer main.

3.2 Bulkheads used with staged construction shall be sound, reasonably free of knots and warps and have a 3-inch nominal thickness.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Bulkheads will not to be measured separately but shall be considered subsidiary to the sanitary sewer main or sewer manholes.

4.2 PAYMENT: The labor, materials, and installation of bulkheads are not to be paid separately but shall be considered subsidiary to the sanitary sewer main or sewer manholes for which payment is made.

END OF SECTION

SECTION 03400
SANITARY SEWER MAIN TELEVISION INSPECTION

PART 1 – GENERAL

1.1 SCOPE

A. The Work covered by this Section consists of furnishing all labor, supervision, tools, equipment, materials, permits, and incidentals to televise, inspect, video, still photograph and document recording of sewer mains and manholes utilizing a color closed-circuit television (CCTV) inspection unit to evaluate the condition of the sewer infrastructure. All televised and recorded information shall be written to DVD video in a format specified by the Owner.

B. Televising may be observed by the Inspector, Engineer or Contractor as the camera is run through the system. All abnormalities, such as, but not limited to, misaligned joints, cracked/defected pipe, rolled gaskets, encrustations, mineral deposits, debris, shall be documented as part of the CCTV inspection.

C. Removal of all debris, solids, sand, grease, grit, rock, etc. from sewer mains, manholes, or structures to facilitate television inspection shall be included as part of this Work.

1.2 RELATED SECTIONS

A. Section 03100, Sanitary Sewer Main

B. Section 03120, Sewer Service Laterals

C. Section 03200, Sanitary Sewer Manholes

D. Section 03410, Sanitary Sewer Testing

1.3 REFERENCE STANDARDS

A. Texas Commission of Environmental Quality (TCEQ)

1. Chapter 213 Edwards Aquifer Recharge Zone

2. Chapter 217 Design Criteria for Domestic Wastewater Systems

1.4 SUBMITTALS

A. The Contractor shall provide a DVD and log of the televised system for review and approval by the Owner, Engineer and/or Inspector. DVDs must be in a format readable with standard viewing software such as Windows Media Player. If the Contractor provides a DVD of such poor quality that it cannot be properly evaluated, the Contractor shall re-televise as necessary at no additional cost to the Owner.

1. PACP Report and Top View Report for each section of pipe using NASSCO's PACP Standards unless otherwise instructed by the Engineer or Owner.

2. Separate line for each deficiency and location.

3. Corresponding video and location of each section of pipe and deficiencies on digital video.

B. The television unit shall also have the capability of displaying in color, on DVD, pipe inspection observations such as pipe defects, sags, points of intrusion, offset joints, service connection locations and any other relevant physical attributes. Each DVD shall be permanently labeled with the following:

1. Project name;

2. Date of television inspection;

3. Station to station location and size of sanitary sewer main;

4. Street and easement location;

5. Name of Contractor;

6. Date video submitted;

7. Video number;

8. Inspector's name.

C. The Contractor shall provide a line diagram area drawing and written log of findings for each DVD submitted. The drawing and written log shall include a description and location of the pipe segment televised, flow and camera direction, position of service connections, description and location of failures, overall pipe condition and weather conditions at the time of the CCTV inspection.

PART 2 - P R O D U C T S

2.1 QUALITY ASSURANCE

A. Equipment used shall be in good working order and provide continuous operation during TV/video inspection.

B. CD / DVD disks shall be of good visual quality capable of slow motion and pausing without significant reduction of visual quality.

C. Contractor must be NASSCO/PACP certified and certification number submitted to Owner and Engineer prior to commencement of Work.

D. Video image shall be calibrated using a Marconi Resolution Chart No. 1 or equivalent.

2.1 EQUIPMENT AND MATERIALS

A. Television Camera

1. The television inspection equipment shall have an accurate footage counter which displays on the monitor the exact distance of the camera from the center of the starting manhole.

2. Camera used shall be 360-degree COLOR RVC camera.

3. Camera shall be operative in 100% relative humidity and be specifically designed for the environment.

4. Camera shall have an integral lighting system capable of producing clearly focused, well-defined images of the entire periphery of the pipe.

5. The quality of video picture and definition provided shall be to the satisfaction of the Owner and Engineer and, if unsatisfactory, equipment shall be removed and replaced with satisfactory equipment.

6. The camera height shall be centered in the sewer main being televised.

7. The speed of the cameral shall not exceed 40 feet per minute.

B. Video Recording Equipment

1. Furnish video equipment to provide a visual and audio recording of all areas in the pipe. Video recording system at the site shall be capable of rewind, play back, slow motion and stop motion.

2. The video shall be recorded on a CD, DVD, or equal portable storage device whose format is compatible with Windows XP Pro. Also, an audio channel for clearly recording the camera locations and operator observations (cracks, leaks, service connections, etc.).

3. The system shall continuously indicate distance, in feet, from manhole to manhole and the manhole-to-manhole run numbers on the video recording.

C. Power Supply

1. Power supply shall be continuous. If night operations occur, supply all labor, power and lighting equipment for operations, traffic safety, permits, etc.

PART 3 - EXECUTION

3.1 GENERAL

A. New Mains: Recommended Cleaning

1. All mains and manholes should be clean of debris prior to televising. The sanitary sewer main shall be flushed within 72 hours of televising and recording. This will assure the main is clean of debris as well as identify any potential sags within the main.

2. All sanitary sewer gravity lines shall be televiewed at the Contractor’s expense; and a video recording of the subject mains provided prior to preliminary acceptance and at the 1-year warranty inspection by the Owner. Televiewing may only occur after the stabilized subgrade has been installed and satisfactory density tests have been submitted to the Engineer. The Owner’s authorized representative must be present during the televiewing, unless otherwise approved by the Owner. The sewer video inspection shall include rotating the camera lens to inspect the interior of each sewer lateral.

3. Demonstrate the ability of the televised and video equipment (camera/light/video/audio/photograph system) to the satisfaction of the Owner and Engineer. Distance meter shall be furnished on the digital video recording. Meter shall be checked using distances between manholes.

3.2 TELEVISING INSPECTION

A. Inspection shall be done one manhole section at a time.

B. Locate video vehicle on upstream side of manhole. Recording shall begin during the lowering of the camera into the manhole opening. Video in the downstream direction such that camera movement is with the flow. Camera lens shall be positioned looking along the axis of the sewer. The camera axis should be within ±10% of the vertical sewer centerline of the pipe. For oval shaped pipes, the camera shall be positioned vertically above the invert at a height ⅔ of the vertical dimension of the pipe.

C. Insert the camera in the upstream manhole after flow restrictions required have been accomplished. Flow into the system being inspected shall be stopped, except for service laterals into the system being inspected. Move camera through the pipelines at a moderate speed not exceeding 30 feet per minute. Excessive use of the pan and tilt features should be avoided. Stop camera at locations where one or more of the following conditions is observed:

1. Infiltration/inflow sources.
2. Service Laterals.
3. Structural defects including broken pipe; collapsed or collapsing pipe, cracks, deterioration, punctures, etc.
4. Abnormal joint conditions such as misalignments, open joints, and joints not sealed.
5. Unusual conditions such as root intrusion, protruding pipes, inline pipe size changes, mineral deposits, grease, and obstructions.

D. Stop camera long enough for a thorough visual inspection of the conditions. All such conditions as specified above, along with the corresponding the Pipeline Assessment and Certification Program (PACP) code for each condition, shall be audio recorded on video and the inspection log sheet. Move the camera and rotate to obtain optimum view of the conditions. Each condition should be framed as to provide a full perspective. If requested by an Owner's representative, view problem areas in the opposite direction by pulling the TV camera from the opposite direction at no additional cost to the Owner.

E. While the camera is stopped at each service connection, rotate the camera to be able to view the service connection for a length of time that enables a good visual inspection of the service connection for damage and infiltration. Be responsible for measurements such as service lateral locations, if used for subsequent rehabilitation work.

F. When, during the inspection operation, the television camera will not pass through the entire manhole-to-manhole section, set up equipment so that the

inspection can be performed from the opposite manhole at no additional cost to the Owner. All reasonable effort should be given to video the entire segment including the removal of obstructions, reversals, location and exposure of buried manholes, use of more versatile equipment, etc.

G. Any defects or anomalies detected on new construction that does not meet the Owner's requirements shall be corrected by the Contractor prior to the Owner and Engineer's acceptance. Once corrected, the portion(s) shall be videoed, again, to assure the modification(s) was made correctly.

3.3 CONSTRUCTION METHODS

A. The Contractor is required to have all material, equipment, and labor force on site prior to isolating the sewer manhole segment and beginning the inspection operations.

B. Clean sewer lines and manholes as needed to allow free travel of the camera.

C. Television inspection shall be done one section (between two manholes) at a time.

D. The internal pipe flow shall be bypassed if the line is in service, and the flow exceeds 25% of the internal pipe diameter. Flow can be reduced to allowable levels by performing bypass pumping, after a bypass plan has been submitted and approved.

E. The Contractor shall not be allowed to float the camera. If the camera is unable to move down the sewer pipe due to an inspection, the Contractor shall contact the Owner, Engineer and/or Inspector and clean the system as necessary to continue the inspection. If, the obstruction is due to a collapsed main or pipe deflection, televising shall be suspended, and payment shall be made based on the actual linear feet of main televised. The blockage shall be corrected by the Contractor at his expense, and the remaining televising of the sewer line shall continue. No additional payment shall be made for additional setups required due to obstructions encountered during televising.

F. In the event of accidental spill or overflow, immediately stop the discharge and take action to clean up and disinfect the spill. Promptly notify the Owner so that required reporting can be made to the Texas Commission on Environmental Quality (TCEQ) and the Environmental Protection Agency (EPA) by the Owner. In the event of accidental spill or overflow, the Contractor is responsible for any damages that may have occurred to public or private property including cleaning, disinfection, and other corrections to the satisfaction of the Engineer at no cost to the Owner.

G. The Contractor shall be responsible for any and all damage of the sanitary sewer mains that results directly from the television inspections, at the Contractor's expense.

3.4 MAINTENANCE OF TRAFFIC

A. Be responsible for all maintenance of traffic around work site. Contractor shall maintain traffic in accordance with all federal, state and local regulations. At no additional cost to the Owner, submit a Maintenance of Traffic Plan, for review and approval by the Engineer as necessary, prior to commencing Work. Obtain all necessary permits prior to commencing Work, at no additional cost to the Owner.

B. Maintenance of traffic shall also include construction and maintenance of any necessary detour facilities, furnishings, installing and maintaining of traffic control and safety devices during construction, control of dust, and any other special requirements for safe and expeditious movement of traffic around or through the work site.

C. Be responsible for coordination with all affected agencies when roadways will be closed, or traffic will be detoured. No detours or roadway closings shall be permitted unless specifically received approval from the Owner.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity that is measured per linear feet for payment shall be done for post television inspection on the basis of unit price bid per linear foot of sanitary sewer main based on the diameter sizes described within the payment subsection. This Work shall include full compensation for all labor, materials, equipment, tools, logging, bypass pumping, settlement testing, cleaning, hauling materials, tools, debris disposal, inspection, and incidentals necessary to complete the Work.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, equipment tools, logging, cleaning by bypass pumping, and incidentals necessary to complete the Work based on the unit bid price per linear foot on the following pipe diameters:

- 8-inch through 15-inch
- 18-inch through 24-inch
- 27-inch and larger

A. No additional compensation shall be provided for all needed repairs, re-cleaning, or re-televising effort.

B. There will be no separate pay item for this Work for bypass pumping associated with this Work.

C. There will no separate pay item for ramps, steel plates, or other methods be employed by the Contractor to facilitate traffic over surface piping.

END OF SECTION

SECTION 03410
SANITARY SEWER TESTING

PART 1 – GENERAL

1.1 SCOPE

A. The Contractor shall furnish all labor, materials, equipment, appurtenances, and services to conduct the air, infiltration, exfiltration, and pipe deflection tests in accordance with these specifications.

B. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 REFERENCE STANDARDS

A. Texas Commission of Environmental Quality (TCEQ)

1. Chapter 217 – Design for Domestic Wastewater Systems

B. American Society for Testing and Materials (ASTM) International

1. ASTM C 828 – Standard Test Method for Low Pressure Air Test of Vitrified Clay Pipelines.
2. ASTM C 924 – Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
3. ASTM D 3034 – Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
4. ASTM F 794 – Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
5. ASTM F 1417 – Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air.
6. ASTM C 1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

1.3 RELATED SECTIONS

A. Section 03100, Sanitary Sewer Main

B. Section 03200, Sanitary Sewer Manholes

C. Section 03400, Sanitary Sewer Main TV Inspection

1.4 SUBMITTALS

A. The Contractor shall submit the Manufacturer’s product data instructions, recommendations, shop drawings, and certifications.

B. Submit test plan before testing and in adequate timing to obtain approval by Engineer.

C. Include testing procedures, methods, equipment, and tentative schedule.

D. Obtain advance written approval for deviations from drawings and specifications.

E. Submit test reports for each test on each segment of sanitary sewer.

PART 2 – EXECUTION

Testing of Installed Pipe: The Contractor shall perform a low-pressure air test or an infiltration/exfiltration test, and for pipe installed by open cut method, a settlement test before installed Work shall be considered accepted. If a gravity collection main is composed of flexible pipe, a deflection test will be required. Flexible pipe is defined as pipe that will deflect at least 2% without structural distress. Contractor shall insure that all testing is performed in the presence of the Inspector, with copies of all written test results available to the Engineer and Inspector. The pipe shall be inspected with closed circuit television (CCTV) camera. The Contractor shall be solely responsible for making proper repairs to these elements which do not pass these test requirements.

2.1 EXFILTRATION TEST

A. Water for the work shall be metered and furnished by the Contractor.

B. The main shall be filled with water for its complete length or by sections as determined by the Engineer. If tested for its complete length, the maximum head at any point shall not exceed 25 feet unless otherwise indicated. If tested in sections, the manholes in the test section shall be filled with water. After the main has been filled and allowed to stand for 24 hours, the amount of exfiltration shall be calculated. Any amount more than 200 gallons per inch of inside pipe diameter per mile per day shall be cause for rejection.

C. Portions of mains located within the Edwards Aquifer Recharge Zone or within any recharge area or recharge feature within the Edwards Aquifer Transition Zone, the minimum head during testing shall not be less than 2 feet and the leakage rate shall not exceed 50 gallons per inch of inside pipe diameter per mile per day. This rate shall apply for the entire portion of the main extending up to the first manhole located outside the recharge zone, recharge area, or recharge features indicated on Drawings and shall also be applicable for any recharge areas or recharge features which may be identified during construction.

D. Construction within the 25-year flood plain, the exfiltration rate shall not exceed 10 gallons per inch diameter per mile of main per 24 hours at the same minimum test head.

2.2 INFILTRATION TEST

A. When the main placed in easements is completed, the upper portion of the trench backfill shall be removed to a depth of not less than 18 inches below the finished surface and width equal to the original trench width. The trench shall then be flooded with water until it is completely saturated, and water stands in the ditch a minimum of 12 inches deep. In cases of steep terrain, earthen dikes shall be used to assure that water will stand over the trench. After it is apparent that the trench is completely saturated, the main shall then be inspected with CCTV for infiltration. Any section of the main or any service stub that indicates infiltration above the maximum quantity specified shall be cause for rejection.

B. This procedure shall not be used for mains installed in areas where the Plasticity

Index (P.I.) of the surrounding material is 20 or higher or where the backfill material has a P.I. of 20 or more.

C. Portions of mains located within the Edwards Aquifer Recharge Zone or within any recharge area or recharge feature within the Edwards Aquifer Transition Zone, the total infiltration as determined by water test, must be at a rate not greater than 50 gallons per inch of pipe diameter per mile of pipe per 24 hours at a minimum test head of two feet. This rate shall apply for the entire portion of the line extending up to the first manhole located outside the recharge zone, recharge area, or recharge features indicated on Drawings and shall also be applicable for any recharge areas or recharge features which may be identified during construction. Construction within the 25-year flood plain, the infiltration rate shall not exceed 10 gallons per inch diameter per mile of pipe per 24 hours at the same minimum test head.

D. If the quantity of infiltration exceeds the maximum quantity specified, remedial action must be undertaken to reduce the infiltration to an amount within the limits specified.

2.3 SETTLEMENT TEST

A. During the infiltration test or after the exfiltration test, the main will be TV inspected for possible settlement. When air testing has been used, water shall be flushed into the pipe to permit meaningful observations. Prior to flushing, the manholes and pipes should be cleared of all debris. Any pipe settlement which causes excessive ponding of water in the pipe shall be cause for rejection. Excessive ponding shall be defined as a golf ball (1-5/8” diameter) submerged at any point along the line.

2.4 LOW PRESSURE AIR TEST OF PLASTIC GRAVITY SEWER MAINS

A. General

1. Wastewater mains, at the discretion of the Engineer, shall be air tested between manholes. Backfilling to grade shall be completed before the test and all laterals and stubs shall be capped or plugged by the Contractor so as not to allow air losses, which could cause an erroneous test result. Manholes shall be plugged so they are isolated from the pipe and cannot be included in the test.

2. All plugs used to close the sewer for the air test shall be capable of resisting the internal pressures and must be securely braced. Place all air testing equipment above ground and allow no one to enter a manhole or trench where a plugged sewer is under pressure. Release all pressure before the plugs are removed. The testing equipment used must include a pressure relief device designed to relieve pressure in the sewer under test at 10 psi or less and must allow continuous monitoring of the test pressures in order to avoid excessive pressure. Use care to avoid the flooding of the air inlet by infiltrated ground water. (Inject the air at the upper plug if possible.) Use only qualified personnel to conduct the test.

B. Ground Water

1. Presence of ground water will affect the test results; test holes shall be dug to the pipe zone at intervals of not more than 100 feet and the average

height of ground water above the pipe (if any) shall be determined before starting the test.

C. Test Procedure

1. The Engineer may, at any time, require a calibration check of the instrumentation used. Use a pressure gauge having minimum divisions of 0.10 psi and an accuracy of 0.0625 psi (one ounce per square inch.) All air used shall pass through a single control panel. Clean the sewer to be tested and remove all debris where indicated. Wet the sewer prior to testing. The average back pressure of any groundwater shall be determined (0.433 psi) for each foot of average water depth (if any) above the sewer.

2. Add air slowly to the section of sewer being tested until the internal air pressure is raised to 4.0 psig greater than the average back pressure of any ground water that may submerge the main. After the internal test pressure is reached, allow at least 2 minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure. After the temperature stabilization period, disconnect the air supply. Determine and record the time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig greater than the average backpressure of any ground water that may submerge the main. Compare the time recorded with the specification time for the size and length of pipe as given in the following table:

Table for Low Pressure Air Testing of Plastic Pipe:

Minimum Specified Time Required For 1.0 psig Pressure Drop For Size and Length of Pipe Indicated								
Diameter of Pipe, (in.)	Specification Time (min: sec) for length shown							
	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

NOTES: Specification times are as given in UNI-B-6 RECOMMENDED PRACTICE FOR LOW-PRESSURE TESTING OF INSTALLED PIPE -- by Uni-Bell PVC Pipe Association.

3. Any drop in pressure, from 3.5 psig to 2.5 psig (adjusted for groundwater level), in a time less than that required by the above table shall be cause for rejection. When the line tested includes more than one size pipe, the minimum time shall be that given for the largest size pipe included.

4. Test procedure for sewer main located in the Edwards Aquifer Recharge Zone or identified recharge areas or recharge features within the Edwards Aquifer Transition Zone:

i. Low-pressure air tests must conform to the procedure described in ASTM C-924 or other equivalent procedures. For safety reasons, air testing of main sections will be limited to main sizes of 36 inches inside diameter or less. Mains that are 36 inches or larger inside diameter may be air tested at each joint. The minimum time allowable for the pressure to drop from 3.5 pounds per square inch to 2.5 pounds per square inch gauge during a joint test, regardless of main size, shall be twenty (20) seconds.

ii. Sections of main less than 36-inch inside diameter, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge must be computed by the following equation:

T = 0.0850 (D)(K)/(Q)

T = time for pressure to drop 1.0 pounds per square inch gauge in seconds;

K = 0.000419(D)(L), but not less than 1.0;

D = nominal inside diameter in inches;

L = length of line of same pipe size in feet; and

Q = rate of loss, assume 0.0015 cubic feet per minute per square foot (ft3/min/ft sq) of internal surface area.

iii. Any drop in pressure, from 3.5 psig to 2.5 psig, in a time less than that required by the above formula shall be cause for rejection. When the line tested includes more than one size of pipe, the minimum time shall be calculated for the largest size pipe included.

iv. Manholes must be tested separately and independently. All manholes must be hydrostatically tested with a maximum loss allowance of 0.025 gallon per foot diameter per foot of head per hour.

v. When mains are air tested, manholes are to be tested separately by exfiltration or vacuum method in accordance with Section 3200 of these Specifications.

2.5 PRESSURE TEST FOR FORCE MAIN

A. A pressure test must use 50 pounds per square inch above the normal operating pressure of a force main.

B. A temporary valve for pressure testing may be installed near the discharge point of a force main and must be removed after a test is successfully completed.

C. A pump isolation valve may be used as an opposite termination point.

D. A test must involve filling a force main with water.

E. A pipe must hold the designated test pressure for a minimum of 4.0 hours.

F. Each pressure test shall pass the allowable leakage determined according to the following formula, unless otherwise directed by the Owner. Leakage shall be defined as the quantity of makeup water required to hold the specified test pressure for the duration of the test period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour as determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

L = quantity of makeup water, in gallons per hour. S = length of pipe section being tested, in feet. D = nominal pipe diameter, in inches. P = average hydrostatic test pressure, in psi (gauge).

2.6 DEFLECTION TEST

G. Deflection tests shall be performed by the Contractor on all flexible and semi-rigid wastewater pipes based on the 30 TAC § 217 standards.

H. The deflection test must be accurate to within +/- 0.2% deflection. The test shall be conducted after the final backfill has been in place for at least 30 days. No pipe shall exceed a deflection of five percent. If a pipe should fail to pass the deflection test, a second test shall be conducted to rectify the errors and after the failed area's final backfill has been in place an additional 30 days. The tests shall be performed without mechanical pulling devices. Upon completion of construction, the Engineer shall certify to the Inspector that the entire installation has passed the deflection test. This certification may be in conjunction with the notice of completion required in 30 TAC § 217.14. This certification shall be provided for the Owner to consider the requirements of the approval have been met.

I. Mandrel:

i. Testing for in-place deflection shall be with a pipe mandrel or rigid ball sized at 95% of the inside diameter of the pipe.

ii. A second test of flexible and semi-rigid wastewater mains 18-inch size and larger, also with a main mandrel or ball sized at 95% of the inside diameter of the pipe, shall be conducted by the Contractor 30 days prior to expiration of his warranty on the Work.

iii. All mandrel dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

iv. The rigid mandrel shall be constructed of a metal or a rigid plastic material that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number is an odd number.

v. The barrel section of the mandrel shall have at least 75% of the inside diameter of the pipe.

vi. A proving ring shall be provided and used for each size mandrel in sue.

vii. Contractor shall submit his proposed main mandrels or testing balls to the Engineer or Inspector for concurrence prior to testing the main.

viii. Test(s) must be performed without mechanical pulling devices and must be witnessed by the Engineer or Inspector.

ix. Any deficiencies noted shall be corrected by the Contractor and the test(s) shall be redone.

x. Test Reports: Submit reports from tests in accordance with relevant standards.

PART 3 – MEASUREMENT AND PAYMENT

3.1 MEASUREMENT: Unless shown on the drawings or called out within the specifications as a pay item, the air, infiltration, exfiltration, and deflection testing quantities shown or described are for information purposes only. No separate measurement for these testing procedures will be made by the Contractor for this work.

3.2 PAYMENT: Unless specified as a pay item, the air, infiltration, exfiltration, and deflection settlement testing will not be paid for directly but will be subsidiary to the pertinent items associated with construction activities. No separate payment will be made to the Contractor for this work.

END OF SECTION