SECTION 02642

DUCTILE IRON PIPE

1. GENERAL

This specification covers all ductile iron piping for use in water treatment, supply and distribution systems in the various services as shown on the plans.

2. APPLICABLE STANDARDS

The latest version of the following standards shall apply to items referenced in this specification:

2.1. American National Standards Institute (ANSI)/American Waterworks Association (AWWA)

- ANSI A21.11/AWWA C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- ANSI A21.15/AWWA C115: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
- ANSI A21.16/AWWA C116: Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
- ANSI A21.50/AWWA C150: Thickness Design of Ductile-Iron Pipe
- ANSI A21.51/AWWA C151: Ductile-Iron Pipe, Centrifugally Cast

2.2. American National Standards Institute (ANSI)/National Sanitation Foundation (NSF)

- ANSI/NSF 61: Drinking Water System Components - Health Effects

3. SERVICE

The ductile iron pipe furnished shall be approved for use in potable water systems and shall comply with ANSI/NSF 61. All piping shall be new, first quality materials.

4. DESIGN REQUIREMENTS

Ductile Iron Pipe shall be designed and manufactured in accordance with ANSI A21.50/AWWA C150, ANSI A21.51/AWWA C151, and ANSI A21.15/AWWA C115, latest revision. All pipe shall be designed for the following minimum conditions:

4.1. Working Pressure

Working pressure shall be as specified on the plans. If no working pressure is specified on the plans, the working pressure shall be one hundred fifty (150) pounds per square inch (psi). Pipe with Push-on Joints or Mechanical Joints shall be Class 50 and Flanged Joint pipe shall be Class 53.

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Deleted: Ductile Iron Pipe shall be Class 50 for Push-on Joint or Mechanical Joint and Class 53 for Flanged Joint. All pipe must be new. The pipe, fittings, coatings, lubricants, gaskets, etc., must be NSF, Standard 61 approved; when used for potable water systems (This certification must be included with all submittals).

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4.2. Surge Allowance

Surge allowance shall be as specified on the plans. If no surge allowance is specified on the plans, surge allowance shall be one hundred (100) psi. For design purposes, surge allowance shall be added to the working pressure.

4.3. Laying Condition

All pipe, fittings, and appurtenances shall be buried with a minimum of 6" of compacted sand completely around the pipe, including bell.

4.4. Cover

Cover shall be a minimum of three feet (3') or as shown on plans.

4.5. Design Loading

Pipe shall be designed to withstand AASHTO H-20 Truck loading.

5. JOINTS

Ductile Iron Pipe shall have Rubber Gasket Joints in accordance with ANSI A21.11/AWWA C111, latest revision with the exception that gaskets containing asbestos material or natural rubber will not be permitted. Unless otherwise noted on the plans, buried pipe may be either Mechanical Joint or Push-on Joint. Pipe above ground shall be Flanged.

6. FITTINGS

Fittings for ductile iron pipe shall comply with the requirements of Section 02651, "Pressure Water Pipe Fittings and Assemblies". Fittings shall be as shown on the Plans and generally above ground fittings shall be flanged and fittings below ground shall be mechanical joint with restrained mechanical joint rings. Where the plans indicated joint restraints are required, the restraints shall comply with Section 02641, "Pipe Restraint Systems".

7. COATING AND LINING

Buried pipe shall be bituminous coated outside. All buried ductile iron pipe shall be encased in polyethylene encasement as outlined in Section 02643, "Polyethylene Sleeve".

All above ground piping shall be primed and painted. The paint system shall be as indicated on the plans or as identified in the specifications. Primer for piping to be painted shall be applied at the point of manufacture.

Buried pipe shall be bituminous coated outside and cement lined and seal coated inside in accordance with ANSI A21.16/AWWA C116, latest revision when used for potable water systems.

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8. FLANGED PIPING

All Flanged pipe shall comply with ANSI A21.15/AWWA C115, latest revision. Nominal thickness of pipe shall not be less than Class 53. All flanges shall be Ductile Iron and rated for working pressure of two hundred fifty (250) psi.

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9. TESTING AND INSPECTIONS

9.1. Hydrostatic Testing

All pipe shall be hydrostatically proof tested at five hundred (500) psi after manufacture.

9.2. Certifications

The Manufacturer will furnish Owner sworn certificates that pipe and joints have been manufactured, tested, and inspected in accordance with applicable specifications.

9.3. Independent Test Certificates

At the Owner's option, the Engineer may direct the pipe manufacturer to furnish test certificates from an independent testing laboratory certifying that pipe conforms to the applicable specifications.

10. WALL CASTINGS

Mechanical Joint Wall Sleeves will be utilized when possible. They shall be made of cast iron or ductile iron, as specified, and they shall allow for flexibility and field adjustment. MJ Wall Sleeves shall be one static casting. Fabricated Wall Castings shall have cast or ductile iron wall collars and shall be welded on both sides. Screwed-on bells will not be accepted.

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11. INSTALLATION

The pipe shall be laid to the lines and grades specified by the Engineer. After the pipe has been laid, sand backfill shall be brought up uniformly on each side of the pipe and mechanically tamped to a point six (6) inches above the pipe. Care shall be exercised to see that the sand is well tamped under the pipe before bringing backfill up on the sides of the pipe. No voids or loose material under the pipe will be permitted. This sand backfill shall be mechanically tamped.

After this mechanically tamped backfill has been placed, the remainder of the trench shall be backfilled and this portion of the backfill material shall be water consolidated. The material used shall be free from rocks or boulders or other unsatisfactory materials.

12. BONDING

A positive means of electrical conductivity across Push-on Joints and Mechanical Joint shall be provided for ductile iron pipe. The bond shall be "Electro-Bond" as manufactured

by U.S. Pipe or approved equal. The bond shall use a 1/16" x 3/4" copper strip with welded and bolted connections. The bond shall be capable of carrying 500 to 600 amps for extended periods of time without overheating. The copper shall be Type 122 deoxided conforming to ASTM B-152, latest revision, and the bolts and nuts shall be silicon bronze. The bond shall withstand expansion or contraction movement of the pipe.

13. SUBMITTALS

Unless otherwise specified, the Contractor shall make all submittals in accordance with Section 01300, "Submittals". The following submittals shall be required for this work item:

- Material descriptions sufficient to demonstrate compliance with ANSI/NSF 61.
- Manufacturer's data on all of the pipe and accessories to be used, including the applicable standards under which the material will be furnished.
- Any shop drawings and calculations demonstrating compliance with applicable standards.

14. MEASUREMENT AND PAYMENT

Ductile iron pipe included in the Base Bid will not be measured separately and shall be paid for as a part of the Base Bid as outlined in Section 00105, "Proposal". Ductile iron pipe used as a part of the additive alternate bid items for the various line sizes will be paid on a per installed foot basis as outlined in Section 00105, "Proposal". Ductile iron pipe included in any of the Alternate Bid Items shall be measured and paid as a part of the applicable bid item.

*** END OF SECTION ***

SECTION 02649

POLY-VINYL CHLORIDE (PVC) PRESSURE PIPE

1. GENERAL

This specification covers the requirements for Polyvinyl Chloride (PVC) Pressure Pipe for use in water treatment, supply and distribution systems.

2. APPLICABLE STANDARDS

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The latest version of the following standards shall apply to items referenced in this specification:

2.1. American National Standards Institute (ANSI)/National Sanitation Foundation (NSF)

- ANSI/NSF 61: Drinking Water System Components - Health Effects

2.2. American Waterworks Association (AWWA)

- AWWA C900: PVC Pipe and Fabricated Fittings, 4 In. Through 12 In. for Water Transmission and Distribution
- AWWA C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm)

2.3. American Society for Testing and Materials (ASTM)

- ASTM D1785: Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- ASTM D2241: Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
- ASTM D2672: Joints for IPS PVC Pipe Using Solvent Cement
- ASTM D3139: Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- ASTM F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe

3. SERVICE

All PVC pressue pipe and joint materials furnished shall be approved for use in potable water systems and shall comply with ANSI/NSF 61. All piping shall be new, first quality materials. As specified below Dimension Ration (DR) or Standard Dimension Ration (SDR) designates the ratio of the outside diameter to the wall thickness.

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4. PIPE

4.1. Three (3) Inch and Smaller Pipe

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All PVC pressure pressure pipe three inch (3") diameter and smaller shall meet the requirements of ASTM D2241 and shall be furnished in steel pipe equivalent outside diameters. Three inch (3") and two inch (2") pipe shall have an SDR of 21 with a pressure rating of 200 psi. Three inch (3") and two inch (2") PVC pipe shall have Schedule 40 wall thickness. One inch (1") and smaller pipe shall have Schedule 80 wall thickness.

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Unless otherwise specified, two inch (2") through three inch (3") pipe shall have synthetic rubber gasketed integral bell and spigot push-on joints, meeting the requirements of ASTM D3139. Synthetic rubber gasket materials shall meet the requirements of ASTM F477, and natural rubber rings will not be acceptable. Pipe smaller than two inch (2") shall have solvent cemented integral bell and spigot slip joints, meeting the requirements of ASTM D1785 and ASTM D2672. With either gasketed or slip joints, the bell shall consist of an integral wall section fabricated as a part of the pipe and the bell section shall be designed to be at least as strong as the pipe wall. In instances where special joint lengths or splices are required, slip-joint coupling fittings, meeting the requirements of Section 02651, "Pressue Water Pipe Fittings and Assemblies" may be used.

4.2. Four (4) Inch and Larger Pipe

Four inch (4") through twelve inch (12") diameter PVC pressure pipe shall meet the requirements of AWWA C900, and shall be furnished in cast-iron pipe equivalent outside diameters. PVC pressue pipe fourteen inch (14") diameter and larger shall be meet the requirements of AWWA C905 and shall be furnished in cast-iron pipe equivalent outside diameters. Four inch (4") and larger pipe shall be Class 150, with a DR of 18, unless otherwise specified on the plans. Four inch (4") and larger pipe shall meet the requirements of Uni-Bell Standard Uni-B-2-72 and shall be approved by Underwriter's Laboratories for use as a fire main.

Four inch (4") and larger pipe shall have synthetic rubber gasketed integral bell and spigot push-on joints, meeting the requirements of ASTM D3139. The bell shall consist of an integral wall section fabricated as a part of the pipe and the bell section shall be designed to be at least as strong as the pipe wall. Synthetic rubber gasket materials shall meet the requirements of ASTM F477. Natural rubber rings will not be acceptable.

4.3. Joint Length

Pipe shall have a standard laying length of twenty (20) feet, plus or minus one (1) inch, for all sizes. At least ninety (90) percent of the total footage of pipe of any class and size shall be furnished in standard lengths. The remaining ten (10) percent may be furnished in random lengths. Random lengths will not be less than ten (10) feet long.

5. PRESSURE TESTING

Each standard and random length of pipe shall be tested to four (4) times the pressure class of the pipe for a minimum of five (5) seconds. The integral bell shall be tested with the pipe. In addition, pipe shall not fail when subjected to the following tests outlined in ASTM D2241: sustained pressure, burst pressure, flattening, and extrusion quality.

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6. FITTINGS

Fittings for PVC pressure water pipe shall comply with the requirements of Section 02651, "Pressure Water Pipe Fittings and Assemblies."

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7. INSTALLATION

PVC pipe shall be installed in accordance with the requirements of Section 02635, "Pressure Water Pipe Installation", and with the Uni-Bell Plastic Pipe Association guide for installation of PVC pressure pipe for municipal water distribution systems.

8. SUBMITTALS

Unless otherwise specified, the Contractor shall make all submittals in accordance with Section 01300, "Submittals". The following submittals shall be required for this work item:

- Material descriptions sufficient to demonstrate compliance with ANSI/NSF 61.
- Manufacturer's data on all of the pipe and accessories to be used, including the applicable standards under which the material will be furnished.
- Any shop drawings and calculations demonstrating compliance with applicable standards.

9. MEASUREMENT AND PAYMENT

PVC pressure pipe included in the Base Bid will not be measured separately and shall be paid for as a part of the Base Bid as outlined in Section 00105, "Proposal". PVC pressure pipe used as a part of the additive alternate bid items for the various line sizes will be paid on a per installed foot basis as outlined in Section 00105, "Proposal". PVC pressure pipe included in any of the Alternate Bid Items shall be measured and paid as a part of the applicable bid item.

*** END OF SECTION ***

SECTION 02653

GATE VALVES

1. GENERAL

This specification covers all governs gate valves and associated equipment, including operators.

2. APPLICABLE STANDARDS

The latest version of the following standards shall apply to items referenced in this specification:

2.1. American National Standards Institute (ANSI)/American Waterworks Association (AWWA)

- ANSI/AWWA C500: Standard for Metal-Seated Gate Valves for Water Supply Service
- AWWA C509: Standard for Resilient-Seated Gate Valves for Water Supply Service

2.2. American National Standards Institute (ANSI)/National Sanitation Foundation (NSF)

- ANSI/NSF 61: Drinking Water System Components - Health Effects

3. SERVICE REQUIREMENTS

Gate valves, including coatings, shall be approved for use in potable water systems by the National Sanitation Foundation (NSF) Standard 61.

4. GATE VALVES AND OPERATORS

4.1. Valves Three (3) Inches and Larger

Valves ranging from three (3) inches in diameter to twelve (12) inches in diameter shall be resilient seated, full-wedge non-rising stem, o-ring valves complying with AWWA C509. Valves larger than twelve (12) inches shall be non-rising stem, O-ring, gate valves complying with the latest revision of ANSI/AWWA C500. The valves shall have a full, round, unobstructed flow way. Gate valves shall have a fusion epoxy coated minimum 6 mils thick inside and outside. Valves containing asbestos materials or natural rubber will not be allowed.

Unless otherwise specified, valves used in underground service shall have mechanical joint connections and operators that terminate in a standard square operating nut. Valves used in underground service shall be encased in polyethylene sheet as outlined in Section 02643, "Polyethylene Encasement". Valves used in above ground service shall have flanged joint connections and be furnished with a standard handwheel, or handwheel and square operating nut if required. Tapping

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valves used in underground service shall have a mechanical joint connection on one side and a flange on the tapping sleeve side.

4.2. Valves Smaller than Three (3) Inches

Gate valves smaller than three (3) inches in diameter, shall be all-bronze, non-rising stem, O-ring, valves manufactured and installed in a manner consistent with the of ANSI/AWWA C500. Two (2) inch through three (3) inch valves shall be supplied with transition gaskets allowing them to accept steel-pipe-equivalent outside diameter PVC pipe. Valves small than two (2) inches shall be threaded joint valves, with appropriate threaded by slip-joint, solvent cement PVC transition fittings.

Unless otherwise specified, valves used in underground service shall have operators that terminate in a standard square operating nut. Valves used in underground service shall be encased in polyethylene sheet as outlined in Section 02643, "Polyethylene Encasement". Valves used in above ground service shall be furnished with a standard handwheel.

4.3. Operation

Gate valves shall opened by turning counter-clockwise. The valves shall have triple o-ring seals; two above the thrust collar, and one below.

4.4. Warranty

The valve manufacturer shall provide a written ten-year warranty with the valve submittals.

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5. VALVE ACCESSORIES AND DETAILS

5.1. Valve Boxes

An adjustable valve box and cover shall be set over each buried valve, complete with cover marked "Water" and similar to Tyler Pipe Catalogue No. 6890-A. A section of 6" diameter PVC pipe shall be used from the valve to the box as illustrated on the plans.

5.2. Valve Joints and Bolts

All flanged valve bolts shall be either galvanized or stainless steel. Mechanical Joint valves shall have standard ductile iron "T" bolts, and shall be furnished with the restrained mechanical joint rings. All flanged joints shall be made using full face synthetic rubber gaskets. Natural red rubber gaskets and gaskets containing asbestos materials will not be allowed for either flanged or mechanical joint connections.

Buried valves shall be loose wrapped in two layers of 8 mil thick black polyethylene before backfill is placed.

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Before shipping, the Supplier shall submit detailed drawings, specifications, and installation and maintenance instructions for the approval of the Engineer. Six (6) copies of detailed O.& M. Manuals shall be submitted for approval of the Engineer.¶

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6. SUBMITTALS

Unless otherwise specified, the Contractor shall make all submittals in accordance with Section 01300, "Submittals". The following submittals shall be required for this work item:

- Material descriptions sufficient to demonstrate compliance with ANSI/NSF 61.
- Manufacturer's data on all of the valves and accessories to be used, including the applicable standards under which the material will be furnished.
- Any shop drawings and calculations demonstrating compliance with applicable standards.
- Installation and operations and maintenance instructions for the valves from the manufacturer.

7. MEASUREMENT AND PAYMENT

Gate valves will not be measured separately and shall be paid for as a part of the Base Bid as outlined in Section 00105, "Proposal".

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SECTION 02680

NEW GRAVEL PACKED WATER WELL

1. GENERAL INFORMATION

The work to be completed under this specification shall include furnishing all materials, equipment, tools, labor and incidentals necessary for the drilling, casing, developing, testing and completion of a gravel packed water well.

2. MATERIALS

Materials used in well shall be all new materials and shall comply with the requirements of the American Water Works Association (AWWA) Standards, the requirements of the Texas Commission on Environmental Quality (TCEQ), along with the following requirements:

2.1. Surface Casing

The surface casing shall be installed from the surface down to a depth of fifty (50) feet and shall be a minimum twenty (20) inch outside diameter (O.D.) steel pipe with a wall thickness of 0.375 inches. The surface casing shall be new (not previously used) steel pipe.

2.2. Well Casing

The well casing pipe shall be heavy duty 304 stainless steel (SS) seamless pipe, meaning no longitudinal seams, as manufactured by Wyman Gordon, PEXCO or Engineer approved equal. No structural pipe or mill reject pipe shall be used. The well casing pipe shall be a minimum fourteen (14) inch O.D. with a wall thickness of 0.375 inches and weighing not less than fifty (50) pounds per foot. Well casing joints shall be threaded, with the threads integrated into the pipe. In lieu of integrated threads, welding will be an acceptable method of joining sections of piping. Couplings will not be allowed for joining the well casing pipe or for joining the well casing to the well screen.

2.3. Well Screen

Well screens shall have a continuous slot design and shall be constructed of veeshaped trapezoidal wire continuously wrapped around an array of equally spaced support rods. Each junction of wire/rod contact shall be resistance welded. The well screens shall be fabricated entirely of 304 stainless steel with a nominal screen opening of 0.020 inches. This screen opening shall be confirmed by the city based on the sieve analyses of all major producing sand zones prior to Contractor's ordering of screen. The well screen shall have a nominal fourteen (14) inch O.D., configured with integral threads to allow the screens to attach directly to either the well casing or subsequent screen sections. Screen sections shall be a minimum of ten (10) feet in length and a maximum of forty (40) feet in length. The well screen shall be Johnson Hi-Flow (HiQ) 304 Stainless Steel as manufactured by Weatherford or Engineer approved equal.

2.4. Cement

All cement used shall be neat cement consisting of a mixture of API Spec. 10, Class A and water in the ratio of not more than 6.0 gallons of water per 94 pound sack of cement.

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2.5. Filter Pack Gravel

Filter pack gravel shall be rounded river rock gravel; angular crushed stone shall not be allowed. Gravel shall be clean, washed and free of foreign materials. The Engineer's preliminary analysis indicates that gravel will be required to conform to the following sieve analysis for formation sand:

Sieve Size	% Retained
12 (1.68 mm)	0 – 8
16 (1.20 mm)	14 – 30
20 (0.853 mm)	47 – 63
30 (0.599 mm)	82 – 100

Contractor shall provide grain size distribution curves on three samples of the formation sands from three different levels as selected by Engineer. Final sieve analysis of the gravel shall be specified by Engineer based on these aquifer sand analyses. Contractor shall confirm that the gravel furnished complies with the final requirement by furnishing a size distribution curve showing such compliance prior to placing of the gravel in the well. Additionally all gravel must be disinfected with a 50 mg/L chlorine solution as it is being added to the well cavity.

2.6. Drilling and Completion Fluids

All drilling and completion fluids shall be suitable for use on potable water wells and shall be National Sanitation Foundation (NSF)/American National Standards Institute (ANSI) Standard 60 certified.

3. DRILLING AND COMPLETION

The drilling of the new water well must be performed by a waterwell driller licensed under the Texas Department of Licensing and Regulation.

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3.1. Coordination with the Engineer

The Contractor shall provide at least forty eight (48) hours notice to the Engineer prior to initiating drilling and cementing operations.

3.2. Cementing Operations

All cementing shall be done in the presence of a representative of the Engineer. To ensure that there will be sufficient cement to properly seal from the bottom of the casing to the top of the ground without any interruption in the process, the Contractor shall have available for constant use at least forty percent (40%) more cement than the quantity calculated to be sufficient for the work. The process shall be continued until the cement reaches the surface of the ground. After the cement has been allowed to set for a period of not less than twenty-four hours, the Contractor shall resume operations and shall continue until the well has been completed.

3.3. Surface Casing

The Contractor shall drill, and cement the surface casing to a depth of 50 feet. If conditions encountered indicate that the depth of the surface casing needs to be extended, the Contractor shall advance the surface casing to the depth as specified by the Engineer, with payment for this additional work to be made as outlined in the Additive Alternate bid item.

3.4. Initial Well Depth

Initially, the well shall be drilled to an approximate depth of 300 feet, provided that should the drill be in sand at 250 feet, drilling operations shall continue until this sand is penetrated or to a depth of 300 feet. The Contractor shall keep accurate record of the location of the top and bottom of each stratum penetrated and shall retain, collect and bag one sample for every ten feet of depth to Total Depth (TD).

3.5. Drilling Method

The well shall be drilled using the wet rotary drilling method. Drilling fluids shall utilize either bentonite or a synthetic polymer for soil stabilization. The Contractor shall obtain approval from the Engineer for the specific drilling equipment and materials to be used. The Contractor may not use surface pits at this facility and shall manage all drilling fluids in above ground, portable tanks.

3.6. Alignment

The total depth of the hole (approximately 300 feet) shall be drilled within one degree (1^{o}) of a plumb line. The Contractor shall maintain a written tabulation of depths and their corresponding angles from the vertical. Alignment checks will be made at every 100 ft. depth interval and to the final depth of the well.

3.7. Drilling Log (Subsurface Strata Description)

During the drilling of the well, the Contractor shall complete a graphic and written log of the drill hole showing the depth, thickness and characteristics of strata penetrated.

3.8. Electric Hole Log

After the hole has been drilled, the Contractor shall run an electric log to check the log of the driller to ensure the proper setting of the casing and screen. This log shall report (1) resistivity, (2) self potential, (3) caliper, (4) compensated density, and (5) gamma ray.

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3.9. Setting the Depths and Intervals of the Well Screen/Casing

The water supply in the well shall be developed from acceptable water bearing sands between a depth of 100 feet and 300 feet. All strata, bearing water of satisfactory quality ten feet or more in thickness, shall be developed to maximum capacity. Unless otherwise instructed by the Engineer, the Contractor shall set 190 feet of screen. That portion of the well casing opposite impervious strata shall consist of blank pipe. The Contractor shall obtain approval from the Engineer for the specific locations of the well screen prior to placement.

3.10. Positioning of Inner Screen and Blank Casing

The portion of the well casing within the surface casing shall consist of blank casing pipe. The top of the well casing shall extend approximately two (2) feet above natural grade. The section of the well casing within the surface casing shall be centered using a minimum of three centering guides at equal spacing. Below the surface casing, the well shall be cased with a liner consisting of sections of well screen and blank casing pipe as stipulated by the Engineer. Centralizers shall be used on the well casing every 50 feet below the end of the surface casing.

3.11. Setting the Well Screen

The bottom end of the well screen shall be equipped with an approved back pressure valve and ten feet of blank casing pipe. A saw toothed nipple shall be left on the bottom end of the lowest screen which shall be set in the rat hole which shall center the lower end of the screen in the hole.

3.12. Under-reaming and Graveling

After under-reaming a minimum of a 24 inch hole has been completed to a depth of 300 feet, the well shall then be thoroughly and properly graveled by use of a high pressure hydraulic pump in such manner as to insure the complete filling of the hole which has been surrounding the entire screen and any intervening blank casing pipe from the bottom of the well to at least two (2) feet above the top of the well screen. The Contractor shall take adequate precautions so that no sand or formation materials caving shall bridge the gravel and prevent its contact with the screen or intervening blank casing pipe. The process shall be continued until the space, as specified, is filled with gravel. This procedure shall be done in the presence of the Engineer.

3.13. Cementing of the Well Casing

Cementing between the surface casing and the well casing above the screen shall be completed after initial development of the well. A 2" diameter gravel pipe shall be left in place through this cement to provide for later addition of the gravel if this becomes necessary.

3.14. Surface Completion

Following the cementing of the well casing, the Contractor shall provide a reinforced concrete pad surface completion as shown on the drawings. This pad shall cover the top of the surface casing and shall be poured against the well casing. The top of the pad shall be elevated at least three (3) inches above grade level and shall be sloped to provide drainage away from the well casing. The pad shall be a minimum of eight feet by eight feet (8' x 8') with a six (6) inch minimum thickness.

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3.15. Video Inspection

Upon the completion of the well, the Contractor shall conduct a full depth video inspection of the well. The video shall be capable of providing a full 360º view of the well materials and shall be indexed by depth. The video equipment shall also be capable of capturing still shots of critical items. Still shots shall be obtained for the following:

- Any anomalies or damaged areas in well casing
- Representative joints in the well casing and the well screen.
- Well screens, at a maximum of five foot intervals, but with sufficient detail to allow the entire screened interval to be documented.
- The bottom of the well.

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3.16. Well Log

During the completion of the well, the Contractor shall complete a graphic and written log of the well installation showing the depth and description of the various sections of casing, screens, laps and seals, and equipment.

4. DEVELOPING AND TESTING

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4.1. Well Devlopment Testing & Disposition

Prior to developing the well, the Contractor shall secure appropriate water samples from the well and have the samples tested for all constituents for which the U.S. Environmental Protection Agency (EPA) has established either a primary or secondary Maximum Contaminant Level (MCL) as well as total suspended solids, turbidity, color and threshold odor limitations and excessive hydrogen sulfide and carbon dioxide. The Contractor shall ensure that these tests are conducted using the appropriate laboratory methods and procedures by a laboratory accredited by the Texas Commission on Environmental Quality (TCEQ) for conducting drinking water analysis. The Contractor shall obtain these samples in an expedited time frame and shall submit the results to the Engineer.

4.2. General

After construction of the well, as described above, the well shall be fully developed in order to obtain its maximum capacity. The Contractor shall furnish all necessary pumps, power units, agitator plungers or other needed equipment, and shall develop the well by such approved methods as shall be necessary to give the maximum yield of water per foot of drawdown and extract from the water bearing formation the maximum practical quantity of such sands as may, during the life of the well, be drawn through the screen when the well is pumped under maximum conditions of drawdown.

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The well shall be bailed, washed, backwashed, agitated, surged, and developed until the water production has a turbidity of not greater than ten (10) Nephelometric turbidity unit (NTU), and the water shall be free of sand so that when a sample of water is allowed to settle for thirty (30) minutes, the amount of sand which is settled out shall not exceed 1.0 ounce of dry sand in 100 gallons of water. The sand content will be measured after twenty (20) minutes of pumping at the maximum rate estimated to be approximately 700 gallons per minute (gpm).

It is anticipated that many various procedures will be required to fully develop the well. It is not intended that these specifications should fully set forth all work involved, and it will be expected of the Contractor to perform his work in accordance with accepted development practices. In addition to other work involved, the Contractor is to perform his work in accordance with accepted development practices. In addition to the other work involved, the Contractor will be required to bail the well free of deposits before beginning, during and after development, and no separate payment will be made for this work.

The final stages of development shall consist of agitation and development of a pumping unit. The base bid price shall include the cost of at least thirty-six (36) hours of continuous pumping.

4.3. Disposition of Water from Well Development and Flow Testing

Based on the results of the initial water testing the Engineer will provide direction to the Contractor on the disposition of water from well development and flow testing activities. Depending on the results of these tests, the Contractor may be required to discharge the water:

- Into the Water Treatment Plant at one of the following locations as dictated by the Engineer;
  - Raw Water Pump Station approximately 420 feet from the proposed well site
  - Sludge Thickner approximately 320 feet from the proposed well site.
  - Ground Storage Tank Number 1 approximately 100 feet from the proposed well site
- Into a sanitary sewer manhole located on the Water Treatment Plant site approximately 200 feet from the proposed well site; or
- Into a surface drainage conveyance on the Water Treatment Plant site

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approximately 20 feet from the proposed well site.

Regardless of the required discharge location, the Contractor shall limit the rate of the discharge to a rate that will not cause flooding or erosion. The Contractor shall meter all water discharged from the well and shall report the quantity of that discharge to the Engineer.

4.4. Development by Pumping Unit

The final stage of development shall consist of pumping the well with a pumping unit for a period of at least thirty-six (36) continuous hours, or as directed by the Engineer. The well shall be thoroughly developed by pumping equipment of sufficient capacity to discharge not less than 700 gpm at the head necessary to give this amount of production at the pump base. It is anticipated that the Contractor will be required to pump at a rate of up to 1,000 gpm for some or all of the development period. Flow during development may be measured by a standard orifice and manometer on the discharge pipe or by a meter.

4.5. Flow Test

After the development has been completed and approved by the Engineer, the Contractor shall conduct an official flow test on the well. Well discharge rate and depth to water surface while pumping shall be measured . Flow will be measured by a minimum six (6) inch flow meter furnished by the Contractor. Depth to water and operating level shall be measured by the Contractor throughout the test at no greater than five (5) minute intervals. All facilities for making the test shall be furnished by the Contractor, including temporary piping and a test pump. Static water level shall be determined prior to starting test. Pump shall be shut down for a minimum of twenty four (24) hours after development and before the flow test. The flow test shall be conducted as follows:

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- A continuous run for thirty six (36) hours shall be conducted at a uniform discharge rate set by the Engineer with a minimum pumping flow rate of 700 gpm up to a maximum of 1,000 gpm.
- After this continuous run, a twenty-four (24) hour rest shall be given during which the recovery shall be measured by the Contractor on hourly intervals.
- After the completion of the flow test and the removal of the test pump the Contractor shall remove any sand which may have been deposited in the well.

5. STERILIZATION AND TESTING

After the well has been developed and cleared of sand, it shall be sterilized with a solution showing a chlorine residual of fifty (50) parts per million for a minimum of six (6) hours.

After the water containing chlorine is completely flushed from the well, a sample of water shall be collected on three (3) successive days and submitted for bacteriological analysis by the Contractor to a laboratory approved by the Department of State Health Services. The Contractor shall submit copies of the reports of this analysis to the

Engineer. If one of these tests failed, the contractor must repeat the sterilization process and obtain three successive passing tests.

After the 36 hour flow test a complete physical and chemical analysis shall be preformed in accordance with TCEQ Sections 290.41(c)(3)(A) & (G) and Sections 290.104 and 290.105 of Drinking Water Standards. Samples shall be tested for all constituents for which the U.S. Environmental Protection Agency (EPA) has established either a primary or secondary Maximum Contaminant Level (MCL) as well as total suspended solids, turbidity, color and threshold odor limitations and excessive hydrogen sulfide and carbon dioxide. A complete report from a certified or accredited laboratory must be submitted to the Engineer before the well may be placed into interim use of the well. The well may not be placed into final service until final approval sampling is conducted by the TCEQ.

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6. SECURITY AND PROTECTION

The Contractor shall exercise such supervision over the well at all times to prevent damage to or loss of the well by contamination through carelessness, vandalism or sabotage during the entire term of the Project.

7. ABANDONMENT OF WELL

In the event it becomes necessary to abandon the well, it shall be permanently sealed from the bottom with neat cement in accordance with Texas Water Development Board procedures and standards for water well and test hope plugging. This includes obtaining necessary permits and handling other legal aspects all to be the responsibility of the Contractor. If abandonment is necessitated by misalignment of hole or other reason obviously due to the fault of the Contractor, all abandonment costs shall be borne by the Contractor in addition to his expense in his attempted drilling and development. If as evidenced by the well log records, and the electric log of the nine inch exploratory hole, it is the considered opinion of the Engineer that the original site is a poor choice, then the Contractor shall move to a second site as directed by the Engineer, and the City shall pay the Contractor the amount stated under "Moving Contingency Reimbursement" in the Bidder's Proposal, said sum being the full and complete payment to be received by the Contractor for his efforts prior to his starting operations at the second site. The nine inch test hope shall be plugged by cementing, of so abandoned, at Contractor's expense.

8. SUBMITTALS

8.1. Pre-Installation Submittals

Prior to installing the well, the Contractor shall submit the following items for review and approval by the Engineer:

- Manufacturer's data for each type of material to be supplied for the project. This information shall include material, size, configuration and shall confirm compliance with applicable standards.
- Manufacturer's data on the test pump to be used, including a pump curve.

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- Manufacturer's data on the flow meter to be used, including a manufacturer's certification of accuracy and a meter calibration certificate completed within the past year.
- Sketches detailing the temporary piping connections to be used for proper discharge of the test water
- Manufacturer's information on the specific video and electric logging equipment to be used

8.2. Well Installation Report

Upon completion of the work and prior to acceptance, the Contractor shall submit to the Engineer four (4) copies of a summary report on the well installation, including all pertinent data. This well report shall include:

- A narrative identifying the parties involved in the well installation, the equipment and materials used, including but not limited to casing size, bore hole diameter, total well depth, casing material and casing length, and the dates the various activities were conducted.
- Results of the initial testing
- Alignment Survey
- Drilling log
- A summary of the results of the electric log survey and a narrative interpretation of the electric log.
- Water sand grain-size analysis
- Gravel pack grain-size analysis
- Data of slot openings used in screen
- Well log
- Cementing data, including depth and method
- Record of the 36 hour pump test including final well pump capacity in gpm and feet, t.d.h.
- Results of the bacteriological analysis
- A description of the video inspection and any relevant findings
- Material setting.
- A Digital Video Disc (DVD) of the video inspection (in a sleeve inside the report)
- All still shots made during the video inspection
- A copy of the print-out from the electric log
- A DVD containing an electronic version of the electric log
- Copy of the Official State of Texas Well Report filled out by the water well driller
- Cementing Certificate

8.3. Video Inspection and Electric Log

In addition to the copies furnished with the well inspection reports, the Contractor shall furnish two (2) additional copies of the DVD of the video inspection, two (2) additional hard copies of all still shots made during the video, two (2) additional prints of the electric log and two (2) additional DVDs containing an electronic version of the electric log.

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9. MEASUREMENT AND PAYMENT

Payment for this Bid Item shall be included in the lump sum price for the Base Bid. If adjustment for increases in the depth of the well are approved by the Engineer, such adjustments will be paid based on the additive alternate pricing included in the Bidder's Proposal.

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SECTION 02681

SUBMERSIBLE WELL PUMP, MOTOR AND ELECTRICAL EQUIPMENT, AND DISCHARGE PIPE

1. GENERAL INFORMATION

The work to be completed under this specification shall include furnishing all materials, equipment, tools, labor and incidentals necessary for the installation of a submersible pump and motor in a water well. Installation and wiring of the pump to the terminal box and coordination with the electrical contractor for verification of pump rotation and overcurrent protection shall be required of the Contractor and reflected in his bid.

2. WELL AND DESIGN DATA

The following information describes the water well into which the submersible pump and motor will be installed along with basic design data for the installation:

1.	Nominal diameter of the well casing	14”
2.	Nominal depth of the well (below ground surface [BGS])	300’ BGS
3.	Amount of water to be pumped	700 U.S. GPM
4.	Static water level (estimated)	40’ BGS
5.	Pumping water level	80’ BGS
6.	Lift above ground	40’
7.	Depth of setting	100’ BGS
8.	Total length of cable required	150’
9.	Line voltage	460v – 3 phase
10.	Discharge pipe – 8”	110’

The conditions presented above are only for bidding purposes and the final selection of the pump, motor and controls shall be made after development and final testing of the well is complete, as outlined in Section 02680.

3. MATERIALS/EQUIPMENT

Materials used in the well shall be all new materials and shall comply with the requirements of the American Water Works Association (AWWA) Standards, the requirements of the Texas Commission on Environmental Quality (TCEQ), along with the following requirements:

3.1. Submersible Pump

The submersible pump shall be new and shall have a stainless steel housing, screen and impeller. The pump shall have a minimum 75 hp motor, with a minimum Wire to motor efficiency of 75%. The submersible pump shall have a threaded connection to allow the discharge piping to connect directly to the body of the pump. Acceptable

manufacturers for submersible pumps shall be Layne/Christensen, ITT/Goulds or Engineer approved equal. Impellers may be trimmed in accordance with manufacturers recommendations to achieve specific head/flow relationships meeting the project requirements.

3.2. Electrical Supply

The electrical supply line to the submersible pump shall be continuous from the pump to the electrical control panel. The Contractor shall obtain the written approval from the Engineer prior to completing any splices in this electrical supply line. This line shall comply with all the requirements of the electrical specifications.

3.3. Discharge Piping

The pump discharge shall be schedule 40 ASTM A53 Grade B carbon steel pipe approved for potable water service. The discharge pipe shall be nominal 8" with an outside diameter (O.D.) of 8.625 inches. Discharge pipe joints shall be threaded, and may either have the threads integrated into the pipe or may be accomplished through the use of couplings. The pipe shall have be epoxy coated inside and out. The epoxy coatings must be suitable for potable water and shall be National Sanitation Foundation (NSF)/American National Standards Institute (ANSI) Standard 60 certified.

3.4. Tie Straps Assemblies

The Contractor shall furnish stainless steel banding material to affix the electrical supply line to the discharge piping at twenty (20) foot intervals. The Contractor shall also supply vinyl tubing with an inside diameter (I.D.) large enough for the stainless steel banding to be passed through the interior of the tubing. This tubing shall be suitable for contact with potable water.

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4. SETTING OF PUMP

The Contractor shall ensure that the submersible pump and discharge pipe assembly are sufficiently supported at all times to prevent the free fall of the assembly into the well. As the assembly is lowered into the well, the electrical supply line shall be fastened to the discharge pipe column at intervals not exceeding twenty (20) feet. The line shall be fastened to the discharge pipe column using vinyl zip-ties inserted inside vinyl tubing. The purpose of the vinyl tubing is to protect the insulation on the electrical line from being cut by the edges of the zip-ties. The electrical line shall be fastened to the discharge pipe column in a manner that minimizes twisting of the electrical line. If the electrical line is damaged during setting of the pump, the Contractor shall notify the Engineer. Based on an inspection of the electrical line, the Engineer may require the contractor to replace the entire electrical line from the submersible pump to the control panel near the well head.

5. COORDINATION OF ELECTRICAL WORK

All electrical materials and work shall be in compliance with Electrical Specification

(Division 16), the City of Pharr's Codes and Ordinances, the National Electric Code (NEC), latest edition, and with NEMA standards. The Contractor is to notify the Engineer prior to all piping and electrical work.

6. SUBMITTALS

The Contractor shall provide manufacturer's data for each type of material to be supplied for the project. This information shall include material, size, configuration and shall confirm compliance with applicable standards. Prior to ordering the submersible pump, the Contractor shall furnish a proposed pump curves showing the discharge head, flow capacity, pump efficiency, overall efficiency, brake horsepower and horsepower output, over the complete range of the bowl/impeller assembly.

7. MEASUREMENT AND PAYMENT

Payment for this Bid Item shall be included in the lump sum price for the Base Bid. If adjustment for increases in the depth of the well are approved by the Engineer, such adjustments will be paid based on the additive alternate pricing included in the Bidder's Proposal.

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