Enprotec | Hibbs & Todd

July 22, 2025

CITY OF MONAHANS
MUNICIPAL WATER WELL # 4 - 16

Addendum No. 2

Attention is called to the following modifications to the referenced Plans, Specification and Contract Documents for the referenced project. The City of Monahans will receive sealed Bids for the Municipal Water Well # 4 – 16 project at Monahans City Hall, located at 112 W. 2nd Street, Monahans, Texas 79756, until **11:30 a.m.**, local time on **Thursday July 24, 2025**, at which time the sealed Bids received will be publicly opened and read. We hereby modify as follows:

BID DOCUMENTS

CONTRACT:

1. Specification 02672 – Water Well – **DELETE** the existing specification, and **REPLACE** with the attached.

Clarifications:

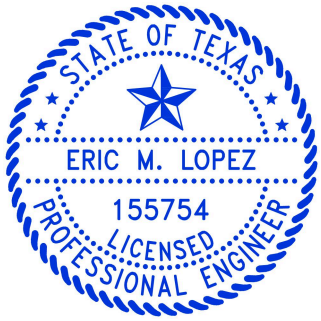
Request for proposal will not require a bid bond

Well pad will be adjusted by the City to include 185' X 100' pad for construction purposes.

RTU Shall be provided by SCADA Contractor See Appendix of Technical Specifications for Scope

This addendum consists of twenty-three (23) pages and becomes a part of the referenced plans, specifications and contract documents and shall be acknowledged by the proposer and attached to the sealed proposal submitted.

By: Eric Lopez, P.E. #155754
Project Manager



7/22/2025

SECTION 02672

WATER WELL (Steel)

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Municipal water well including the drilling, screen, casing, gravel pack, sealing, grouting, accessories and appurtenances.

1.2 REFERENCES:

A. API RP 13B - Recommended Practice Standard Procedure for Field Testing Drilling Fluids.

B. API Spec. 5 – Specification for Tubing and Casing

C. API Spec. 5L - Specification for Line Pipe.

D. API Spec 10 - Specification for Materials and Testing for Well Cements.

E. ASTM A – 53 Standard Specification for Pipe, Steel, Black, and Hot – Dipped, Zinc – Coated, Welded, and Seamless

F. ASTM A – 312 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

G. ASTM A714 - Standard Specification for High-Strength Low-Alloy Welded and Seamless Steel Pipe.

H. ASTM C33 - Standard Specification for Concrete Aggregates.

I. ASTM C136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

J. ASTM C150 - Standard Specification for Portland Cement.

K. ASTM D75 - Standard Practice for Sampling Aggregates.

L. ASTM D1784 Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

M. ASTM D 1785 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

N. ASTM F480 - Standard Specification for Thermoplastic Water Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80.

O. AWWA A100 - Standard for Water Wells.

P. AWWA C200 - Standard for Steel Water Pipe, 6 inch and Larger.

Q. AWWA C206 - Standard for Field Welding of Steel Water Pipe.

R. AWWA C654 - Standard for Disinfection of Wells.

S. AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

T. EPA-570/9-75-001 - Manual of Water Well Construction Practices.

U. NEMA MGI - Motors and Generators.

V. NSF 61 – Drinking Water System Components – Health Effects.

W. TCEQ 30 TAC 290 - Subchapter D: Rules and Regulations for Public Water Systems.

X. TDLR 16 TAC, Chapter 76 Water Well Driller's and Water Well Pump Installer's Rules.

1.3 DESIGN REQUIREMENTS:

A. The purpose of this project is to add an additional well for use and in conjunction with the existing wells currently utilized. The new well, along with the existing wells, will provide a potable water supply. Installation of the new well shall utilize industry recognized construction techniques, equipment and materials. Well capacity and total dynamic head (TDH) requirements shall be determined based on actual field data from the test well and the down-hole conditions observed when the new well is drilled, completed, and tested. Although design parameters have been given below for bidding purposes. It is the intent of the Engineer to accurately estimate the design parameters and final design parameters may change based on development and performance testing.

B. Expected design parameters for the proposed wells are as follows:

1.	Design conditions:		1500 US gpm
2.	Well Casing Size:		18″ internal diameter (minimum)
	a.	Length	180′ + 2 seal block′
3.	Well Screen Size		18″ V wire wrapped (304 SS)
	a.	Length	260′
	b.	Slot Size	0.040″
4.	Stainless Steel Sump Size		18″ internal diameter (minimum)
	a.	Length	10′

5. Dielectric Coupling 18″ Internal diameter (minimum)

1.4 SUBMITTALS:

A. Procedures for Submittals: Section 01300.

B. Product Data: Manufacturer's product data sheets on all materials and equipment incorporated into work including the following:

1. Gravel Pack
2. Casing
3. Screen
4. Drilling mud additives

C. Methods of Construction including but not limited to cementing, disinfection, waste disposal and management, flow and level recording, gravel placement and site protection shall also be submitted.

D. Provide One digital and one hard copy of Well Completion Book including the following:

1. Driller’s Log
2. Geophysical Logs
3. Cementing Certificates
4. Bacteriological Sampling Results

E. Quality Control Submittals: For information only.

1. Water Well Data: The Contractor will submit to the Engineer, in accordance with AWWA A100, copies of all data collected from the water well including: driller's log, pump test data and completion data if applicable.

2. Certificates: Manufacturer's certificates attesting compliance with applicable specifications for grades, types, classes, performance, and other properties.

3. Test Reports: Results of field quality control tests including 36 hour pump tests, bacteriological tests, well head tests, plumbness and alignment tests and hydrostatic tests.

4. Driller's log: In accordance with AWWA A100 and TCEQ - 30 TAC 290.

5. Pump performance curve showing performance of Contractor provided pump for testing purposed. All extraneous information and curves shall be deleted. Specified operating points shall be indicated on curve. The performance curve shall indicate the following:

a. Test pump equipment submittal shall be submitted before installation to ensure proper operating test range.

b. Pump performance over the entire range from shutoff head to maximum flow.

c. Horsepower versus capacity over entire range.

d. Curves shall be presented on 8 ½ inch by 11 inch format.

F. Contract Closeout Submittals: Refer to Section 01700.

1. Protect Record Documents: Submit documents in accordance with Section 01700. Accurately record all information including elevations of pump, screen, casing, water bearing strata and cement.

2. Submit signed copy of driller's logbook statements.

3. Submit executed certification of well pump after performance testing.

4. Submit electronic logs of test pumping results.

1.5 QUALITY ASSURANCE:

A. Water well installation shall be in accordance with the current edition of AWWA A100 “Water Wells”; EPA-570/9-75-001 “Manual of Water Well Construction Practices”; TCEQ 30 TAC 290 “Subchapter D: Rules and Regulations for Public Water Systems”; TDLR 16 TAC, Chapter 76 “Water Well Driller’s and Water Well Pump Installer’s Rules”; and as supplemented by these specifications.

B. Field inspection will be conducted by Engineer and/or Engineer’s representative.

C. Qualifications: Installation of water well shall be accomplished or under direct supervision of a water well driller licensed in the State of Texas with a minimum of five years of experience in the installation of municipal water wells for potable use. Pump installation shall be accomplished or under direct supervision of a pump installer licensed in the State of Texas with a minimum of five years of experience in the installation of municipal water well pumps.

D. Submit proof of state license and qualifications in accordance with Section 01300.

E. The premises, materials, tools, and drilling equipment shall be maintained so as to minimize contamination of the groundwater during drilling operations. The Contractor shall take all necessary precautions to prevent the contamination of the subsurface environment during the construction of the well. The Contractor shall install the necessary items to permanently prevent contaminants from entering the subsurface environment.

F. Should the well become contaminated with water having undesirable chemical or physical characteristics or with any other chemical or toxic substance through negligence by the Contractor or his employees, the Contractor, at his own expense, shall provide casings, seals, sterilizing agents or any other required material or equipment to eliminate the contamination.

G. All wetted parts and materials shall be suitable and acceptable for use in potable water service and NSF-approved.

1.6 Delivery, Storage and Handling:

A. Deliver, store and handle products under provisions of Section 01600.

1.7 Required Permits and Regulatory Requirements:

A. The Contractor shall, at his expense, secure all necessary permits the project requires from applicable state and local entities.

1. Local groundwater conservation district is: N/A

B. Copies of the permits shall be submitted to the Engineer before any work is begun.

C. Contractor shall notify the Engineer at least 72 hours before the pressure cementing of the well casing begins.

D. The Contractor shall also provide to the Engineer all information necessary to gain approval of the well by the Texas Commission on Environmental Quality for municipal use, including but not necessarily limited to the following:

1. Construction data on the completed well, including:

a. Casing size, bore hole diameter (at least 3 inches wider than casing O.D.), total well depth, casing material, casing length, cementing depth and method (one of the pressure methods in AWWA Standard A-100 [latest revision], Appendix C, excluding the dump bailer and tremie methods), screen location(s), gravel depth, and pump setting depth;

b. Driller's geologic log of strata penetrated during drilling of the well;

c. Copy of the official State of Texas Well Report filled out by the water well driller (some of the preceding data is included on the Water Well Report form. (30 TAC 290.41(c)(3)(A), (B), (C) & (G));

d. Cementing certificate (TCEQ, Railroad Commission, or company format). (30 TAC 290.41(c)(3)(A));

e. Electronic Record of a 36-hour pump test on the well showing stable production at the well's rated capacity (30 TAC 290.41(c)(3)(A) & (G)). Pump test shall include electronic Water level measurements (ft) and flow rate (GPM) on a 1 minute basis with both instruments set to same time and logging intervals.

f. Three bacteriological analysis reports showing raw well water to be free of coliform bacterial contamination; reports must be for samples of raw (untreated) water from the disinfected well, collected on three successive days, and submitted to a laboratory certified or accredited by TCEQ. (30 TAC 290.41(c)(3)(A) & (F));

g. Chemical analysis reports for well water samples showing the water to be of acceptable quality for at least, the most problematic contaminants listed below (30 TAC 290.41(c)(3)(A) & (G), and 30 TAC 290.104 and 290.105 of Drinking Water Standards). Reports must come from a certified or accredited laboratory for interim use of the well. Maximum contaminant level (MCL) and secondary contaminant level (SCL) units are shown in the following table:

Constituent	Contaminant Level	Units
Nitrate	10 (as N)	mg/L
Nitrite	1 (as N)	mg/L
Arsenic	10	µg/L
Fluoride	4.0/2.0	mg/L
Aluminum	0.2	mg/L
Copper	1.0	mg/L
Iron	0.3	mg/L
Manganese	0.05	mg/L
Zinc	5.0	mg/L
Total Dissolved Solids	1,000	mg/L
Sulfate	300	mg/L
Chloride	300	mg/L
pH	≥ 7.0	std. units
Alkalinity as CaCO3	-	mg/L
Calcium as CaCO3	-	mg/L
Sodium	-	mg/L
Free Ammonia	-	mg/L
Lead	-	mg/L

Note: If Gross alpha is over 15 pCi/L and Uranium is not reported, then resampling, reanalyzing, and resubmission of complete radionuclide results is required. Additionally, if gross alpha plus radium-228 are over 5 pCi/L, and radium-226 is not reported, then resampling, reanalyzing, and resubmission of complete radionuclide results is required.

E. The location of the well site must conform to TCEQ regulation 30 TAC 290.41 (c), or as directed by the Engineer.

F. No temporary toilet facilities shall be maintained within 150 feet of the well being constructed, unless the facility is of the sealed, leak proof type.

PART 2 PRODUCTS

2.1 MATERIALS:

A. All materials shall be new and conform to AWWA A100, TCEQ Chapter 290, TDLR Title 12 standards or as modified herein.

B. Well construction materials containing more than 0.25% lead are prohibited.

C. Drilling Fluid Additive:

1. Use drilling fluids only as necessary to facilitate the removal of formation cuttings and stabilize drilling operations.

2. The following types of fluids may be utilized: Fresh water based drilling fluid or natural drilling fluids with at least 0.5 mg/l of chlorine and carrying the seal of the National Science Foundation (NSF). Polymer drilling fluids shall be PH – PA type such as Baroid EZ Mud Gold and or PAC type such as Baroid Quick Troll or approved equal. Products shall be utilized in strict conformance with the manufacturer's written instructions. Contractors shall control the solids in the recirculation / mudd pits and shall strive for an ideal mud weight of 9.0 lbs / gallon or less. Mud weights shall be verified often and adjusted accordingly.

3. Should a bentonite type system be employed, Contractor shall employ a manufacturer's representative to watch over the mudding operations and ensure strict conformance with the manufacturer's written instruction verifying viscosity and mud weights regularly.

4. Drilling Fluid additives shall be maintained within limits that allow for their complete removal from the well and not damage the capacity, efficiency, or quality of the well.

5. Additives shall be recorded at the time of use by weight and logged accordingly with resultant weight and viscosity.

6. The drilling fluid additive, if used in the drilling of the well, shall conform to all applicable state standards and shall be approved for use in potable water wells. The drilling fluid additive must also conform to the requirements of AWWA A100.

7. The choice of drilling fluid additive shall be at the discretion of the Contractor, however, no additive will be allowed unless prior approval is obtained from the Engineer.

8. All fluid used in the drilling of the well shall be of sanitary quality and shall contain a chlorine residual of at least 0.5 mg/l at all times.

9. Slush pits shall be constructed and maintained so as to minimize contamination of the drilling mud.

10. Development Chemicals: Chlorine shall be utilized to break down the specified polymer type drilling fluids with a surging action to ensure the polymer is completely broken down.

11. Clay dispersants: Clay dispersants shall be utilized during the surging and bailing process in strict accordance with the manufacturer's written instructions. Dispersants shall have properties similar to NuWell 220 or approved equal.

12. Surfactant: Surfactants can be utilized in conjunction with dispersants in strict accordance with manufacturers written instructions. Surfactants shall have properties similar to NuWell 400 or approved equal.

D. Well Casing (Steel) - API Spec 5L – 42 High strength steel pipe with minimum yield of 42,000 PIS and minimum tensile strength of 60,000 PSI Specifications:

1. Minimum wall thickness in accordance with AWWA A100.

2. Low carbon steel pipe, with plain ends beveled to facilitate the welding of the joints, conforming to AWWA standards.

E. Di-Electric Coupling:

1. A di-electric coupling shall be installed at the interface between the stainless steel screen and mild steel casings. The coupling shall utilize Teflon insulating rings to separate the dissimilar metals and prevent forming a cathodic cell. The coupling shall possess material properties equivalent to the casing including but not limited to tensile strength, collapse pressure, and safety factors. Outside diameter of coupling shall not exceed 1" annulus and the nominal Inside diameter of the casing shall be maintained through the coupling. Couplings shall be as manufactured by Johnson Screen or approved equal.

F. Well Screen:

1. The well screen material shall be AISI Type 304 stainless steel. The well screen shall be of the continuous slot, wire-wound design. The screen shall be fabricated by circumferentially wrapping a triangularly shaped wire around an array of internal rods. The wire configuration shall be such that the wider part of the triangular shaped wire faces outward. The wire and internal rods shall be fusion welded under water by electrical resistance method. The internal rods shall be spaced to provide a design minimum collapse strength of screen consistent with the depth of the well and its diameter. The screen shall also be provided with a driving point or bottom plate as indicated on the drawings and shall be properly sealed to prevent gravel and/or formation material from entering into the screen. Minimum screen tensile strength shall exceed twice the total weight of the screen and casing suspended 1 casing length

above the screened interval. Screen ends shall be square to 0.100 inches over the first 2 feet of the assembly, and the assembly straight to within 0.200 inches over any 10 foot section. Weld rings shall be kept to a minimum. Slot tolerances shall be as follows:

a.	<0.010	+1, -2
b.	0.010 – 0.016	+2, -3
c.	0.017 – 0.030	+3, -4
d.	0.031<	±10%

2. Length and Slot Size:

   a. The screen length, location, and slot size shall be based on manufacturer recommendations, field data and Well Schematics as shown on the Drawings.

3. Manufacturers:

   a. Johnson Screen
   b. Rosco Moss
   c. Alloy Machine Works
   d. Weatherford Screen
   e. Substitutions: Under provisions of Section 01600.

G. Gravel Pack Tube:

1. Gravel Pack tube shall conform to the size shown on the drawings. Ends shall be beveled or threaded with provided couplings and ample space verified to prevent breaching within the annulus. Pipe shall be schedule 40 unless otherwise noted.

H. Gravel Pack:

1. The gravel shall be as shown in the Well Schematics included in the Drawings or approved equal and sized per the recommendation of the screen manufacturer and as approved by the Engineer. The material shall meet the requirements of AWWA A100.

I. Grout - AWWA A100:

1. Neat Cement.
2. Pozmix - Cement Grout.
3. Type 1 Portland Cement Grout.
4. Sand - Cement Grout.
5. Bentonite or Sealing Clay.
6. Setting time accelerators **shall not** be used.

PART 3 EXECUTION

3.1 EXAMINATION:

A. Verify that field conditions are ready to receive work.

B. Beginning of installation means Contractor accepts existing conditions.

3.2 PREPARATION:

A. Owner/Engineer will stake the locations for drilling of test hole for the well.

B. Protect all structures and work near the well from damage.

C. Confirm locations of underground utilities before starting of work.

3.3 INSTALLATION:

A. Slush Pit:

1. The Contractor shall provide and locate a slush pit in the adjacent area where minimal damage to the area and contamination of the drilling fluid is minimized.

2. The slush pit shall be properly sized to settle cuttings and perform integrally with the properties of the drilling fluid and circulation pumps.

3. Fully contained settling tanks will also be acceptable in lieu of slush pits.

4. Contractor Shall backfill the slush pit within 2 weeks of completion with excavated material in incremental lifts to achieve a tight and firm backfill.

B. Plugging Holes:

1. If it becomes necessary to abandon any test hole located on the site, the abandonment procedure of the test hole(s) shall be completed so as to eliminate the possible contamination of the water in the aquifer. Sealing of the test holes shall be done in strict accordance with AWWA A100. The test holes shall also be abandoned in strict accordance with the appropriate State and Local guidelines and regulations. The Contractor shall be responsible for complying with all rules and regulations of the regulatory agencies which govern the abandonment of the test holes. They shall submit all necessary documents to the State and Local regulatory agencies. Copies of the documents shall also be submitted to the Engineer and the Owner.

C. Drilling Procedure:

1. All drilling shall be done by reverse or direct rotary drilling equipment as approved by Engineer, sufficient in size to drill the well to the specified depth and diameter and as shown on the Drawings. The drill hole shall be constructed round, plumb, and true to line as specified in AWWA A100. The vertical alignment of the well shall in no way impede the operation and maintenance of

the permanent pumping equipment utilized. The alignment and plumbness testing of the well shall be in strict accordance with AWWA A100 or by a method approved by the Engineer.

2. Through the drilling procedure Driller shall maintain an accurate legibly written log that is updated concurrently with the drilling operations reference 3. 5. A This section.

3. Straight Plumb test:

   a. The plumbness and alignment testing of the well shall be in strict accordance with AWWA A100 or by a method approved by the Engineer and the casing shall be round, constructed plumb and true to lines as specified.

   b. A straight plumb test shall be made while drilling for each 100 feet drilled. Maximum allowable deviation from vertical is one (1) degree. If after test Contractor believes they will be unable to complete in accordance with alignment specification they shall plug the misaligned hole and redrill anther hole(s) until alignment can be met at the Contractor's expense.

   c. The maximum allowable horizontal deviation, (i.e. drift) of the casing from vertical shall not exceed two-thirds of the smallest inside diameter of that part of the casing being tested per 100 feet as per AWWA A100. The vertical alignment of the casing shall in no way impede the operation and maintenance of the permanent pumping equipment utilized and the stricter of the 2 shall prevail.

   d. Should the casing deviate from the vertical or horizontal alignment herein specified, the Contractor shall notify the Engineer immediately. The Contractor shall correct the deficiency to the satisfaction of the Engineer. Any such correction shall be at the Contractor's expense.

   e. In the event that the testing indicates any type deviation from vertical in the form of a kink, bend, or corkscrew, is present in the well to the extent that it becomes detrimental to the development process as determined by the Engineer or to the installation of future pumping equipment, the alignment shall be checked by lowering a 40 foot dummy with an outer diameter not less than ½" smaller than the inside diameter of the casing being tested. The dummy shall move freely through the entire length of the casing being tested and be able to be lowered under it's own weight. Should the alignment and plumbness of the casing fail to meet the above requirement the Contractor shall be required to correct at their own expense.

D. Casing Guides:

1. Casing guides shall be provided to center pipe in the borehole. Provide 3 guides at no more than 80 foot intervals. Guides shall be evenly spaced around the circumference of the casing. The guide(s) shall be of sufficient size to center the casing without causing damage to the formation.

E. Test Hole:

1. Test hole has been completed near the location of the permanent well. Size of screen and gravel pack are determined for the permanent well based on test hole information. A preliminary well schematic is included in the Drawings.

2. The test hole was drilled to the depth specified for the well or as directed by the Engineer.

3. The Engineer or Engineer's representative was present to collect soil samples to confirm the screen size, and size of gravel pack.

4. Contractor is not relieved of data collection in accordance with AWWA A100, EPA-570/9-75-001 and as specified.

F. Permanent Well:

1. The permanent well shall be constructed to the specified diameter and length as shown on the Drawings.

2. Well length per foot of screened section may be reduced by approximately 50' to assist with budget including all ancillary items, i.e. borehole, gravel pack, screen, etc…

G. Well Casing and Screen:

1. After the completion of the drilling operation and prior to the development of the well, the well casing shall be lowered into the bore hole with each joint of the pipe being butt welded. Welding shall be done in accordance with the American Welding Society Specifications and the American Petroleum Institute Specifications. Welding shall utilize a qualified welder, qualified welding procedures, adequate equipment, filler metal compatible with casing materials, full penetration, avoidance of slag inclusion, and complete filling of the weld space with weld metal. Proof of the welder's and procedure qualifications may be requested by the Engineer prior to any welding.

2. The casing shall be centered in the bore hole and shall be properly braced with centralizers to prevent movement. The centralizers shall be stave-type centralizers with a maximum of 4 staves per centralizer. The centralizers shall be constructed of high strength, low carbon steel or other approved material and shall be welded to

the casing or attached to the casing with a method that will prevent sliding. The centralizers shall be aligned along the casing to allow for installation of the gravel pipe and other appurtenances as shown on the Drawings. Each set of centralizers shall be spaced at 50 feet along the blank casing, with one set immediately below and above a section of screen. Centralizers shall not be attached to the screen.

3. Engineer may provide a hydrogeologist, or other personnel acceptable to the Engineer, to log the bore hole, observe site conditions, conditions of surfaces and installation, quality of workmanship start-up of equipment, as applicable, and to provide instruction when necessary regarding the formation(s) to be screened and the total depth of the well to be completed.

4. The well screen shall also be properly sealed to prevent gravel and/or formation material from entering the screened section of the well casing.

5. Appropriate insulating material shall be installed between the steel well casing and the stainless steel screen to prevent galvanic corrosion between dissimilar metals.

6. Cut off the top of the casing in such a manner to allow for to extend a minimum of one (1) inch above the well sealing block. Do not permit metal cuttings to enter casing. Maintain well opening and casing free of contaminating materials.

H. Gravel Pack:

1. When the gravel packed well is constructed, all gravel shall be of selected and graded quality and shall be thoroughly disinfected with a 50 mg/l chlorine solution as it is added to the well cavity and effectively washed in.

2. After the casing and screen have been placed as specified, the Contractor shall install gravel in the annular space between the well casing and/or screen. The gravel shall extend from the bottom of the well to the depth specified on the Drawings. The gravel shall be free of dirt, trash, clay, or any other foreign substances. Under no circumstance shall the gravel contain iron, manganese, or any other constituent at levels that could affect the quality of the water. The Contractor shall, at their expense, obtain confirmation of the use of the gravel pack gradation with the recommended screen size from the manufacturer. In confirming the screen size, the Contractor shall conform to the requirements of AWWA A100. Gravel shall be placed from the surface with direct circulation through the use of a tremie pipe. Alternate methods of placing the gravel must be approved by the Engineer prior to the construction of the well. Under no circumstances will the direct dumping of the rock into the annular space be allowed, unless it meets the criteria as described herein. An acceptable alternate method must prevent bridging of the gravel pack. The Contractor shall submit to the Engineer a detailed

description of any alternate method considered prior to construction start-up.

3. **Pumped** through gravel feed line with direct circulation (AWWA B.3):

   a. When the assembled casing and screen are centered in the borehole, preparation for the installation of the gravel pack shallb e made according to the requirements of AWWA A100 4.7.6.2. The gravel pack shall be placed by inserting a gravel feed tube in the annular space between the casing and the wall of the bore hole from the surface to a point just above the bottom of the hole. The gravel shall be washed and pumped through this pipe until the annular space is filled to the bottom of the tremie pipe. The gravel feed pipe is then gradually withdrawn as the filter pack is placed. The gravel shall be placed in this manner until the specified depth of the gravel pack is reached. All gravel used in the construction of the well shall be thoroughly disinfected with 50 mg/l of chlorine solution as the gravel is added to the well.

4. **Poured** From the Surface With Direct Circulation (AWWA B.2):

   a. After the casing has been properly placed, tubing or drill pipe with two close-fitting swabs shall be inserted. One swab located near the bottom of the screen and the other near the surface in the blank casing. Clear water shall be introduced into the fluid system until the drilling fluid achieves characteristics required by AWWA A100 4.7.6.2; and a maximum sand content of 1 percent. The gravel shall be placed from the surface through a funnel or orifice in the annular space between bore hole and casing. Swabbing and circulating shall be continued during placement until the gravel pack is completely in place. Before operation is begun, the Contractor shall insure that the circulation will be continuous.

5. Or other methods approved by Engineer in advance

I. Sealing and Grouting:

1. A 10′ bentonite plug shall be placed at the top of the gravel and properly hydrated to ensure grouting does not compromise gravel pack and proper sealing.

2. Bentonite chips shall be allowed adequate hydration time per manufacturer's recommendations before grouting.

3. The grouting mixture used to pressure cement the annular space shall be neat cement as specified in the most current AWWA Standard for Water Wells and to which a maximum of 6%, by dry

weight, bentonite and 2%, by dry weight, calcium chloride may be added.

4. After the placement of the seal or plug on top of gravel pack and acceptance by the Engineer, the Contractor shall seal the space between the casing and drill hole by using enough cement under pressure to completely fill and seal the annular space between the casing and the drill hole. The well casing shall be cemented in this manner from the top of the shallowest formation to be developed to the earth's surface. The well driller shall utilize a pressure cementation method in accordance with the AWWA Standard for Water Wells (A100-20), Appendix C: Section C.2 (Positive Displacement Exterior Method); Section C.3 (Interior Method Without Plug); Section C.4 (Positive Placement, Interior Method, Drillable Plug); and Section C.5 (Placement Through Float Shoe Attached to Bottom of Casing). **NOTE C1 TREMIE METHOD IS NOT ACCEPTABLE**

5. The grout line shall remain in place until enough grout has been wasted on the surface to insure all air pockets and foreign materials have been removed.

6. The cement, after placement and verification that the well is straight and plumb, shall be allowed to set for a period of not less than twenty-four (24) hours, after which any settling of cement at the top of the hole shall be checked and filled to the surface with the same slurry mix as was pumped around the casing. Drilling operations may resume after additional cement has been allowed to set up for 24 hours. Well development shall not be allowed prior to or within 24 hours of placing cement

J. Well Development:

1. After the well is drilled, the casing set, and the gravel pack placed as specified, well is sealed and grouted cured the Contractor shall "develop" the well utilizing one of the following methods. Alternate methods of well development, as outlined in EPA-570/9-75-001, may be used if approved by the Engineer.

a. High Speed Bailing:

i. Development by bailer shall be done with a rig equipped with a power unit capable of bailing with a 12-inch diameter bailer not less than 20 ft in length at a rate of 400 ft/min, unless otherwise directed by the Engineer.

ii. Contractor shall exercise care to prevent damage to the screen during bailing operations.

b. Test Pump with Surging:

i. Install test pump and packer with accessories in accordance with manufacturer's instructions.

ii. Introduction of Chlorine, Dispersants, & Surfactants shall be utilized for full breakdown of the mudding system at this time.

iii. Surging with a packer no longer than 20 feet in length shall be performed from top to bottom and bottom to top (2 passes) concurrently surging a 20 – 40 foot zone. Pumping shall remain concurrent to surging zone until no noted change in water clarity is visible within the zone. Each zone shall be surged and pumped until all zones are completed top to bottom and bottom to top before removing packer.

iv. Test pump shall be provided by contractor and shall be a separate pump from that provided as permanent pumping equipment

v. The Contractor shall utilize a test pump having a capacity in excess of the anticipated lift and final production capacity of the well and a range from 50% to 150% of the anticipated production if a separate test pump will not be utilized.

vi. The pump shall be set to a depth within 10’ of the bottom if a separate test pump will not be utilized.

vii. During the over-pumping of the well with the test pump, a surging action shall be created by periodically shutting off the pump and allowing the water in the pump column to flow back into the well.

viii. Development shall be considered complete once washed, surged and developed with the discharge water having reached a turbidity level of less than 5 NTU and specific capacity stabilized. The Engineer reserves the right to extend or reduce the required pumping time based on development effort.

ix. Engineer may use initial test pump with surging to set the flow rate(s) for the 36 hours pump test and 48 hours’ notice shall be given prior to commencing initial testing with surging.

c. Final Bailing: Immediately following surging the well shall be bailed removing all debris from the well and reconfirming total depth.

2. The development equipment and method used shall permit variable production/development rates.

3. The discharge piping provided shall be of sufficient diameter and length to conduct water to a point designated by the Owner/Engineer, and shall include orifices, meters, or other devices that will accurately measure the flow rate.

4. Operating parameters, duration of development and development records shall be in accordance with AWWA A100 and as directed by the Engineer.

5. The depth of the gravel pack shall be maintained during the development of the well. If necessary, the Contractor shall install additional gravel through a 2 inch steel gravel pipe as shown on the Drawings.

K. Column Pipe:

1. Installation of column pipe shall be in strict accordance with manufacturer's procedures and recommendations.

2. Temporary Column pipe shall be provided by Contractor and shall be separate from permanent column pipe provided for permanent pumping equipment.

3. Prior to installation, drop pipe shall be visually inspected to ensure there is no dirt or foreign matter in the pipe, and any such material which is found shall be removed before installation.

L. Seal Block:

1. After the completion of the well and testing, the Contractor shall install a concrete pad around the well as shown on the Drawings. The pad shall have a minimum thickness of 8 inches. A cast-in-place, concrete sealing block centered on the well shall be installed as shown on the Drawings. The concrete block shall extend a minimum of 24 inches above the concrete pad and sloped to drain away at not less than ¼ inch per foot shall be provided around the wellhead.

2. The concrete slab and block shall be in accordance with the specifications and extend at least three feet from the well casing in all directions. The finished grade of the slab shall slope away from the well in all directions at not less than a ¼ inch per foot.

3.4 WELL ABANDONMENT:

A. Abandonment of Pilot Hole:

1. If the Contractor chooses to drill a pilot hole and not to use the pilot hole for the permanent well, the Contractor shall seal (plug) and abandon the pilot hole. The abandonment procedure of the pilot hole shall be completed so as to eliminate the possible contamination of the water in the aquifer. The sealing of the hole

shall be done in strict accordance with AWWA A100. The pilot hole shall also be abandoned in strict accordance with the appropriate State and Local guidelines and regulations. The Contractor shall be responsible for complying with all rules and regulations of the regulatory agencies which govern the abandonment of the pilot hole. He shall submit all necessary documents to the State and Local regulatory agencies. Copies of the documents shall also be submitted to the Engineer and the Owner.

B. Abandonment of Partially Completed and Completed Wells:

1. If it is necessary to abandon a partially completed or completed well it will be done in strict accordance with AWWA A100, EPA-570/9-75-001, the TCEQ and any local governing agency regulations. The Contractor shall be responsible for submitting all the necessary documents to the State and Local regulatory agencies. Copies of the documents shall also be submitted to the Engineer and the Owner.

3.5 FIELD QUALITY CONTROL AND TESTING:

A. Driller's Log:

1. A driller's log shall be maintained. The driller's log shall conform to the requirements of the TWDB, the TCEQ, and AWWA A100. The Contractor shall, at a minimum, record the following information:

a. The depth of the various formation changes.

b. The reference point for all depth measurements.

c. The static water level.

d. Depth of the bore hole and diameter.

e. Description of the lithology noting color, grain size, consolidation, relative mixture (clean / dirty), and amount of water utilized.

f. The rate of penetration.

g. Noteworthy events including drilling commencement times, interruptions, loss of circulation (including zone depth).

h. The following mud properties shall be described and measured when mud is initially mixed and at any point the mudding system is modified and before all geophysical samples are taken for logs: mud type & constituents, quantities and types of addition(s), mud density. Thinning of mud with water is considered an addition and volume shall be recorded.

i. Any information pertinent to the requirements of the Engineer.

2. Unwashed drill cutting samples shall be obtained by the Contractor shall be obtained by the Contractor for each 5 foot interval of drilling except when drill cuttings, penetration rate, or drilling fluid changes indicate a change in formation at which point samples shall be taken at shorter intervals. Locate samples as to not be disturbed during drilling or construction until approved for disposal or collection

3. The information from the driller's log shall be submitted to the appropriate State agencies and the local underground water district. In all cases, the Contractor shall conform to all ordinances and requirements of State law and/or local governmental entities.

4. Contractor shall maintain a drill pipe tally showing the depth of the bit at all times during drilling.

B. Water Sampling and Testing:

1. Interim acceptance of the well as a source of potable water will be contingent upon a chemical analysis of water produced at the conclusion of the 36-hour well performance test. The Contractor is responsible for notifying Engineer/Owner as to the conclusion of the pump test. Engineer/Owner will collect samples and transport to private laboratory for analysis. Contractor may elect to obtain samples and analyses at no additional cost to the Owner. These tests will determine if water with acceptable quality is produced from the wells. Owner shall provide Contractor copy of results of all analyses performed.

2. Chemical analysis reports are required from the Texas Department of Health (TDH) laboratory in Austin or another laboratory certified by TDH for final well approval. The Contractor is not responsible for this test. The analysis shall include chemical testing in conformance with TDH requirements.

3. The method used to collect samples shall not contaminate the aquifer.

4. The collection and analyses required of the water samples shall be in accordance with TCEQ 30 TAC 290, AWWA A100-97, EPA-570/9-75-001 and as directed by the Engineer.

5. The cost of the collection and transport of the water samples to the independent laboratory will be the responsibility of the Contractor.

C. Well Performance Testing:

1. After completion of the development of the well, the Contractor shall set a test pump or utilize development pump (if and only if correctly sized and approved for performance testing). The test pump shall be equipped with the appropriate power unit and shall be capable of conducting the required testing from 50% through 150% of the anticipated well capacity. The setting of the test pump and its removal after the completion of the tests including all discharge piping and necessary appurtenances shall be provided at the expense of the Contractor.

2. After the initial pumping, the well shall be pumped in accordance with AWWA A100 as directed by the Engineer. During this period, records of draw down and discharge shall be kept. Equipment for accurately measuring the pumping rate shall be installed. The pump test shall continue for a minimum of 36 hours.

    a. Proper development can also be confirmed by the following:

        i. The pumping rate remains constant for at least four hours, and the pumping period has been a minimum of 24 hours, or

        ii. The pumping rate remains constant for at least four hours, and a straight-line trend is observed on a plot of water level versus a logarithm of time during pumping and recovery.

        iii. Engineer reserves the right to request additional development if proper development cannot be confirmed.

3. Electronic Measurements of static water level and pump flow shall be taken at the following designated intervals and set as described, unless otherwise directed by Engineer:

    a. Every minute throughout the duration of the test.

    b. Electronic data collectors shall be set to the same time prior to commencement and shall record the entire duration of the test plus 12 hours of recovery (36 pumping 12 stopped) or until the water level recovers to near or at the original static water level, whichever occurs first. The pump shall not be removed during this recovery period.

4. Manual Measurements of static water level and pump flow shall be taken in conjunction with electronic measurements at the following designated intervals, unless otherwise directed by Engineer:

a. Every minute for first five minutes (0 – 5) plus any additional minutes to reach a 5 minute interval (example 7:43 would require 2 additional minute readings to reach 7:45 or corresponding start time).

b. Every five minutes for next ten minutes (10 - 15) plus any additional 5 minutes to reach an even 15 minute interval (example 7:45 would require 1 additional reading from 7:55 to reach 8:00 or corresponding start time).

c. Every fifteen minutes until the 12th hour (15 mins – 12 hours).

d. Every hour thereafter for 36 hours so as to produce results on an hour basis.

e. Once complete and pumping equipment de – energized five 1 minute intervals and four 15 minute intervals shall be recorded (1 hour of manual recovery data).

5. Rossum Sand cone measurements shall be taken and recorded on the same intervals with notes of "restarting" every time the cone reaches ¾ of its capacity and emptied.

6. Rossum sand cone shall have appropriate valving to set according to manufacturer's recommendations.

7. Records kept during the testing shall be in accordance with AWWA A100, TCEQ 30 TAC 290, EPA-570/9-75-001, and as directed by the Engineer. The results of the test shall be kept by the Contractor and presented to the Engineer prior to the setting of the permanent pump. The permanent pump specifications will be determined by the Engineer based on the pump test data.

8. Any pump equipment used in the hydraulic testing of the well shall not be installed as permanent equipment. Contractor shall furnish all power or make arrangements for all power to operate test pump equipment.

9. Contractor shall notify Engineer at least twenty-four (24) hours prior to the start of pumping for the hydraulic testing.

10. After the hydraulic conditions are determined, Engineer shall determine appropriate permanent well pumping equipment size. Engineer shall direct Contractor as to pumping rate and total dynamic head pumping conditions. Contractor shall submit proposed pumping equipment and design conditions to be approved in writing by the Engineer before ordering the pumping equipment.

3.6 Video Logging:

A. Contractor Shall provide 1 complete video log from start to finish. The footage counter shall be continuous from start to finish and re – zero within reason.

B. Video footage counter shall be reset with the side view at the at the top of the casing for reference upon commencing the video.

3.7 DISINFECTION:

A. The disinfection of the drilling fluid, gravel pack, sand, and other materials and equipment used in conjunction with the drilling, installation and pumping of the well shall be done in the presence of the Engineer and in accordance with AWWA A100 and AWWA C654. **Note: Official Bacteriological Samples shall be taken after permanent pumping equipment has been installed.**

B. Initial disinfection through construction process does not alleviate contractor from final disinfection process and procedures listed in Division 11 specifications.

C. Chlorine dosages can be found in specification 11311, 3.5, G.

3.8 FINAL SITE CONDITIONS:

A. Upon completion of the work all excess material and equipment will be removed from the site by the Contractor in a manner approved by the Engineer.

B. The well site shall be fine graded so that the site is free from depressions, reverse grades, or areas too rough for proper ground maintenance so as to ensure that surface water will drain away from the well. The final condition shall result in all drainage conveyed away from the wellhead.

C. All damage resulting from work in this Section shall be cleaned, repaired or replaced to the satisfaction of the Engineer at no cost to the Owner.

END OF SECTION