Well Technical Specifications

Agricultural Well Technical Specifications

Roosevelt Irrigation District Well Replacement

WC5-221-2024

9-6-24

Contents

1.0 General

1.1 Scope of Work

The work includes the installation of an agricultural well that consists of drilling and completing a well to the depth specified in the design plans using the reverse circulation rotary drilling method. The work also includes the collection of drill cuttings samples, performing geophysical logging, and particle size distribution of selected representative soil samples to aid in the design of the final production well, which will be approved by Roosevelt Irrigation District (RID), hereinafter, Owner. After the final design of the well has been completed the Contractor shall install the well casing, perforated casing and annular materials and develop the well by swabbing and airlifting, and pump and surge methods. Performance testing will follow the well development and will include a step-drawdown pumping test and constant-rate pumping test, the latter including recovery, followed by an as-built well video survey, plumbness and alignment test and gyroscopic survey of the well, and well disinfection and temporary capping. Owner reserves the right to drill beyond the depths specified, or to stop at lesser depths, depending on subsurface conditions encountered during drilling.

The work includes the furnishing of all labor, materials, equipment, tools, supplies, transportation, appurtenances, drilling rigs, pumps, motors, generators, air compressors, piping, drilling makeup water, and services, unless specifically excepted herein, necessary for the complete and satisfactory drilling, construction, development, and performance testing of the well. For bidding purposes, multiple drilling and well completion options are considered:

Well Name	ADWR #	Recorded GPM	Original Depth
Kinery	55-620349	2,267	650’
64	55-607246	1,232	1,000’
65	55-607245	936	800’
66	55-607244	1,344	720’
63	55-607247	1,590	800’

The well shall be drilled and completed pursuant to the plans, specifications and ANSI/AWWA A100-20. Any conflicts in these documents shall be brought to the attention of the Owner for resolution.

1.2 Site Location

The project is located in Glendale Arizona at approximately the cross streets of 103 Avenue and Bethany Home near the NAUSP Recharge Facility and the SRP irrigation canal. Glendale Access to

the well site is via an unpaved graded road east of 107 avenue along the irrigation maintenance road aligned with Bethany Home Road. Figure 1 (Well Location Map) shows the general location of the well site.

1.3 Bid Due Date

Bids for the work specified herein are due on September 12, 2024 at 2:00 pm MST. Bids may be submitted by US Mail or other ground transport to:

Taylor Howerter
Roosevelt Irrigation District
103 West Baseline Road
Buckeye, Arizona 85326

or via email to: Thowerter@rooseveltirrigation.org

Bids received after the due date and time specified will be rejected. RID is not responsible for mail delivered after the due date and time or submitted to the wrong street or email address.

1.4 Definitions

A. Owner. Shall be understood to represent RID, the property owner.

B. Consultant. Shall be understood to represent the person, firm, or corporation with whom the Owner will execute an agreement setting forth the terms and conditions for the work to be performed as specified herein.

C. Contractor. Shall represent the person, firm, or corporation with whom the Owner will execute an agreement setting forth the terms and conditions for the work to be performed, as specified herein.

D. Subcontractor. Shall represent the person, firm, or corporation with whom the Contractor executes a secondary agreement for a portion of the scope of work.

E. Geophysical Logging Subcontractor. Shall represent the person, firm, or corporation with whom the Contractor executes a secondary agreement for the geophysical logging of the well.

F. Drilling Fluid Personnel. Shall represent the person, firm, or corporation with whom the Contractor executes a secondary agreement for the control and testing of the drilling fluid.

G. City. Shall represent the City of Goodyear, Arizona.

1.5 Qualifications

The Contractor shall have no less than three (3) years of local experience using reverse circulation rotary drilling. The Contractor must have successfully completed no less than five (5) separate well

installation projects in Maricopa County, within the past three (3) years involving the installation of agricultural and/or public water supply wells with similar casing dimensions and well depths as specified in the plans.

The Contractor shall hold a valid state of Arizona C-53 Water Well Drilling Contractor License, and all other licenses required by federal, state, county, or municipal rules and regulations.

The Contractor shall provide surety coverage for the value of the contract with a surety company acceptable to RID. The Contractor shall provide proof of insurance and list RID and Consultant as other insured coverage from a company acceptable to RID.

1.6 Performance of Work

The Contractor shall provide all labor, equipment, and materials necessary to complete the work. The Contractor shall employ only competent employees for the execution of the work. The Contractor work crew shall include no less than three (3) workers at all times when drill pipe is being installed or removed (i.e., at all times while the Contractor work crew is tripping or running pipe). In addition, the Contractor shall maintain no less than three (3) workers on site throughout the well installation operations including installation of the well casing, perforated well casing, gravel feed tube, centralizers, gravel pack, bentonite seals and cement seals. All operations shall be performed under the direct and personal supervision of an Arizona-licensed well driller. The Contractor shall assign a foreman (tool pusher) who has been approved by Owner to oversee all work. The Contractor foreman shall be present at the well site at least once daily during each drilling crew shift, during all critical operations, and as requested by Owner. The Contractor foreman shall provide to Owner a written certification that they have read and fully understands these technical specifications prior to mobilization to the well site.

The Contractor shall construct the well in accordance with the Arizona Administrative Code (AAC) Title 12, Chapter 15 Article 8, “Well Construction and Licensing of Well Drillers.” The well construction shall also comply with other applicable Federal, State, County, or local regulations.

Rejection of any materials, work, or equipment by Owner shall be at the Contractor’s expense, and at no cost to Owner. Replacement materials, work, or equipment that is in accordance with these specifications and approved by Owner will be paid for by Owner in accordance with these specifications.

Water will be provided to the Contractor from a Canal. and shall be trucked or pumped by the Contractor to the drill pad for use by the driller. The Contractor shall provide, at its own cost, electricity, piping, valves, meters and other appurtenances to convey water to the work area for its operations under the contract. The Contractor shall obtain construction water from RID in accordance with RID requirements and shall be responsible for all fees for the costs for the purchase of construction water. This includes, but is not limited to, dust control and construction of the well. The Contractor shall also provide drinking water for its operations under the contract.

The Contractor shall provide, at its own cost, noise barriers in accordance with local City Ordinance as required for its operations under the contract. This shall be a line item that may or may not be required per RID.

The Contractor shall provide, at its own cost, all power required for its operations under the contract.

The Contractor shall provide, at its own cost, trash service at the well site during all operations of this project. The trash service shall be adequately maintained and shall be made available to Owner and Consultant personnel for reasonable use, at no cost.

The Contractor shall provide, at its own cost, a portable restroom facility at the well site during all operations of this project. The restroom shall be adequately maintained and shall be made available to Owner and Consultant personnel for reasonable use, at no cost.

1.7 Contractor Responsibilities

If a work delay, deficiency of work performance and/or a material deficiency is caused by the Contractor failing to comply with any item of these specifications, the Contractor shall bear the burden of additional expenses, including any additional Owner charges assessed to the Owner as a direct result of the delay or deficiency. This includes delays due to equipment failure if Owner determines that the equipment failure could have been prevented through proper maintenance.

1.8 Contractor/ Owner Responsibilities

Contractor shall obtain the necessary drilling permits from Arizona Department of Water Resources (ADWR) prior to the commencement of drilling operations. Consultant shall manage the field activities on behalf of the Owner and shall have authority over the Contractor as directed by the Owner. The Owner shall review and approve invoices and any change orders submitted by the Contractor.

1.9 Visitation and Inspection

Owner and Consultant representatives shall, at any reasonable time during the term of work be entitled to review the Contractor's facilities, its program operation, and the records that pertain to the work.

The Contractor agrees that Owner, or Consultant, or any of their duly authorized representatives, shall have access to the Contractor's facilities and have the right to examine books, documents, and records of the Contractor involving transactions related to these specifications.

The Contractor further agrees to include in all subcontracts hereunder, if any, a provision that the Subcontractor agrees that Owner, or Consultant, or any of their duly authorized representatives, shall have access to the Subcontractor's facilities and have the right to examine any books, documents, and records of the Subcontractor involving transactions related to the subcontract and these specifications.

1.10 Confidentiality

The Contractor shall not disclose any information relating to this project or any well site to anyone other than Owner or Consultant without written permission from Owner, except as may be required by law. At all times during the performance of the Contractor's services, the Contractor, Subcontractor, and agents shall treat the work conducted by the Contractor and its Subcontractors and the results thereof as confidential and proprietary to the Owner and Consultant.

Any questions regarding the purpose or scope of work that are directed to the Contractor from individuals or entities other than representatives of the Owner or Consultant while work is being conducted for this project, should be directed by the Contractor to Owner or Consultant.

1.11 Submittals

The Contractor shall be responsible for the timely and accurate submission of all submittals. This includes all shop drawings, materials, data, records, test results, reports, and invoices.

Shop drawings and material submittals shall be reviewed and approved by Owner prior to being ordered, purchased, and installed. This includes, but is not limited to, the following: well casing, well screen, and annular materials. Owner and Consultant may, at its discretion, reject any materials that do not meet the specifications or the requirements of Owner and Consultant.

Data, records, test results, and reports shall be reviewed and approved by Owner and Consultant.

Any additional standby time or other costs incurred by the Contractor as a result of the rejection of a submittal shall not be compensated by Owner and shall be the sole responsibility of the Contractor.

Approval of a submittal shall not in any way relieve the Contractor of the responsibility for completeness, accuracy, errors, and omissions.

Upon completion of all site work, the Contractor shall submit a Well Driller Report and Well Log to ADWR in accordance with Arizona Revised Statutes 45-600 and Arizona Administrative Code (AAC) Rule 12-15-808 within 30 days of completion of the well. The Contractor shall also provide one electronic copy of the Well Driller Report and Well Log submitted to ADWR to Owner within 30 days of completion of all site work.

1.12 Daily Driller's Report

The Contractor shall maintain a daily log of the activities at the site from the time the Contractor mobilizes to the site until the Contractor demobilizes and shall provide a copy to Owner and Consultant daily. The Daily Driller's Report shall be recorded on forms approved by Owner and Consultant. The reports shall give a complete description of all formations encountered; number of feet drilled; number of hours on the job; shutdown due to breakdown; any occurrence of lost circulation conditions, low penetration, fluid additives used; length and type of casing set; volumes

of gravel pack and annular seal installed; and such other pertinent data as may be requested by Owner and Consultant. Contractor personnel will submit the reports to Owner and Consultant daily.

1.13 Delivery, Storage, and Handling of Materials

The Contractor shall be responsible for the timely delivery of materials to the work site. This includes, but is not limited to, the following: well casing, perforated well casing, gravel feed tube, and annular materials. All materials shall be delivered to the site or to an approved storage yard in accordance with the manufacturer's instructions and requirements, except as modified by the plans, specifications or as directed by Owner and Consultant. The materials shall be stored in such a manner as to prevent any damage or contamination. Any damage to the materials shall be reported to Owner and Consultant and all repairs must be approved by Owner and Consultant.

1.14 Rejection of Materials, Work or Equipment

Rejection of any materials, work, or equipment by Owner and Consultant shall be at the Contractor's expense and at no cost to the Owner. The Contractor shall be responsible for the compliance of all material requirements and any materials that do not meet the material requirements as determined by Owner and Consultant shall be rejected.

1.15 Site Protection

The Contractor shall take all necessary precautions to preserve the well site, as nearly as practical, in its present condition. The Contractor shall be responsible for replacing any damaged items. The Contractor shall provide adequate trash receptacles to contain all debris and trash collected at the site. All litter and debris will be cleaned up daily and placed in the trash receptacle for off-site disposal. Contractor is responsible for the location and clearance of all underground utilities and shall complete the utility location request via Arizona811. The Contractor shall be responsible for any damage resulting from its failure to identify and avoid underground utilities, including private utilities that are not marked by the Arizona811 survey.

A plastic tarp (at least 6 mil) and berm shall be placed beneath the drilling rig during mobilization to protect the site and contain any oil or hydraulic fluid spills or leaks and will remain beneath the drilling rig until demobilization. A plastic tarp and berm shall also be placed beneath other stationary equipment such as air compressors, auxiliary lights, welding devices and fuel tanks, and beneath the pump rig and auxiliary equipment during the well development and testing activities. Compressed air introduced into the well during drilling or well development must be treated by passage through a carbon or coalescing filter to remove organic contaminants (e.g., compressor lubrication oil).

If there is an interruption in work, such as mechanical delay, waiting periods required for cement to cure, installation of a test pump, or other instances when the tools are removed from the well and the well is left unattended, a locking cover, tack-welded steel cover, or other Owner and Consultant-approved method of securing the well head shall be installed. During interruptions of work when the

tools remain in the well, such as inclement weather or other circumstances, the well opening shall be covered to prevent the introduction of undesirable material into the well and to ensure public safety.

Water pumped from the well during drilling and development will be delivered to a series of 21,000-gallon liquid storage containers prior to disposal offsite.

After completion of the work, the Contractor shall remove all debris, waste, trash, oil-stained soil, and unused materials or supplies and shall remove all temporary construction facilities such as temporary work areas, temporary structures, and stockpiles of excess or waste materials and shall restore the site, as nearly as possible, to its original condition. In addition, any residual mineral oil within the well casing resulting from the use of test pumping equipment shall be removed prior to final acceptance of the well. Site cleanup must be approved by the Consultant and Owner.

1.16 Disposal of Drill Cuttings, Drilling Fluids and Development and Testing Water

The Contractor shall be responsible for disposal of drilling fluids, well development and testing water on RID land adjacent to Well 65 and the RID CC2 canal. The Contractor shall provide drilling fluids and development and testing water profiling analytical data to the Consultant and Owner for review and approval for the handling of these materials. The drilling and development related waste materials shall be stored in such a manner as to prevent any damage at the well site. Any damage to the site due to leakage or spillage of such materials shall be reported to Owner and Consultant and all remedial actions must be approved by Owner and Consultant.

The contractor will provide a Drill Cuttings, Drilling Fluids and Development and Testing Water management plan that is acceptable to RID.

Disposal of performance testing water, specifically, step-drawdown and constant rate pumping test water, shall be conveyed via pipeline to the CC2 RID canal adjacent to the well site. The Contractor shall provide all equipment, piping, elbows, valves and labor to install and convey performance testing water to the RID canal. The Contractor shall also provide the necessary protection for the water conveyance pipeline where it crosses the roadway. A Traffic Control Plan may be required at and in the immediate vicinity of the water pipeline crossing.

Site cleanup must be approved by Consultant and Owner.

1.17 Noise Suppression

If required, the Contractor shall implement noise suppression practices to mitigate noise levels at residences near the well site as part of its operations in accordance with City Ordinances. Mitigation measures to be employed shall include but not be limited to the installation of sound curtains. The Contractor shall also locate combustion engines and other equipment in positions to direct the greatest noise emissions away from nearby residences and conduct operations in the most effective

manner to minimize noise generation in a timely and economic manner. The Contractor shall re-arrange the site layout if requested by the Owner or Consultant to aid in noise mitigation.

If required, the noise attenuation barriers and or sound curtains shall be 16 feet in height (minimum) and extend along the well site boundary estimated to be 300 feet long.

Support posts for any sound curtains used shall be sufficiently rigid and strong to withstand normal weather conditions and acts of nature. The location and depth of borings necessary for support posts shall be noted on the submitted site plan and require approval by the Consultant and Owner. The Contractor will be responsible for locating all underground utilities, removal of all concrete anchors, and proper backfilling and compaction of all excavations required by this task.

Contractor is responsible for shielding drill rig and site lighting during nighttime operations, limiting impact on neighboring homes. The Contractor shall make every effort to minimize noise or disturbances created from drilling and construction activities during the day and night, especially between the hours of 7:00 pm and 7:00 am.

1.18 Site Safety Plan

The Contractor must institute a Site Safety Plan for this project, in accordance with applicable Occupational Safety and Health Administration (OSHA) requirements. The Contractor is responsible for assuring that Contractor personnel and Subcontractors are thoroughly familiar with the Site Safety and Health Plan (SSHP) and Accident Prevention Plan (APP) for the proposed work. Contractor personnel are required to have been trained in the use of personal safety equipment required by the SSHP. A copy of the SSHP and APP must be kept at the well site and shall be available to all Contractor personnel for review. The Contractor shall be responsible for having sufficient personal safety equipment at the work site for each of the Contractor personnel to comply with provisions of the SSHP and APP. At a minimum, this shall include the following:

1 A first aid kit,

2 A fully recharged and operable type ABC dry chemical fire extinguisher, and

3 An operable mobile telephone is located at each well site. The drilling rig and pump rig mobile phones will be made available to the Owner and Consultant personnel for reasonable use, at no charge.

The Contractor shall meet the requirements of the SSHP at its own cost.

1.19 Construction Water Plan

Water used for the construction of the well shall be provided by off-site RID canals located near the well site. The Contractor will be responsible for transmission of the water to the drill site. It is anticipated the water will need to be pumped or trucked to the drill site; however, piping and appurtenances to convey the water from RID may be possible if approved by the Owner. The

Contractor will also be responsible for any and all costs associated with the installation and operation of construction water transmission facilities required to convey water from RID to the well site as well as all costs associated with the purchase of construction water other than water provide by RID.

1.20 Measurements and Payments

Full compensation for complying with the requirements of Section 1.0 pertaining to drilling rig and support equipment mobilization and demobilization, well site maintenance and clean-up, obtaining water from RID, disposal of drill cuttings and well development and testing fluids, and submittal of various site plans shall be made at the lump sum price for "Mobilization and Demobilization", described as Item No. 1 in Bid Schedule, and no additional compensation will be allowed. In the event sound curtains for noise suppression is required by the OWNER, full compensation for complying with the requirements will be based on a unit cost per the Sound Barriers per Specifications in Bid Schedule. The cost for other types of noise attenuation barriers are covered in the "Mobilization and Demobilization" line item.

***** End of Section *****

2.0 Well Abandonment and Replacement

2.1 General

Should the well be lost due to any negligent action on the part of the Contractor or their Subcontractor (as determined by the Owner), including a result of a material or equipment defect or deficiency, the well shall be destroyed at no cost to the Owner. The Contractor shall credit the Owner for any and all costs associated with the lost well, and this credit shall be applied against any additional Contractor charges associated with the replacement well.

If the loss of the well was not due to any negligent action of the Contractor (as determined by the Owner), the Owner shall provide reimbursement for the replacement well on the basis of the unit costs presented in the Contractor's Bid Schedule.

The exact method of the well abandonment shall be reviewed and approved by the Owner. At a minimum, the well shall be abandoned in accordance with AAC Rule 12-15-816 and local standards.

Consultant/Contractor shall recommend for approval by the Owner a suitable location for the replacement well. A replacement well shall be completed in accordance with the plans, specifications, terms, and conditions herein and shall be within 660 feet of the original Wells.

2.2 Submittals

A. Proposed well abandonment plan in accordance with ADWR Form 55-38, "Notice of Intention to Abandon a Well."

B. Determination by the Contractor of the amount of the credit to be applied against the replacement well costs.

2.3 Measurements and Payments

A. If the loss of the well was due to any negligent action of the Contractor, the Contractor shall credit the Owner for any and all costs associated with the lost well, and this credit shall be applied against any additional Contractor charges associated with the drilling and completion of the replacement well as indicated in the Bid Schedule.

B. If the loss of the well was not due to any negligent action of the Contractor, the Owner shall provide reimbursement for the replacement well on the basis of the Contractor's unit prices as indicated in the Bid Schedule.

***** End of Section *****

3.0 Drilling Fluids

3.1 General

The Contractor shall be responsible for maintaining the quality of the drilling fluid to ensure, at a minimum, the following.

1. Protection of water-bearing and potential water bearing formations exposed to the borehole

2. Representative samples of the formation materials and groundwater

3. Maximum development capacity and optimum potential yield of the completed well

4. Inhibition of the formation and prevention of formation-caused drilling problems (e.g., heaving sands/caving, swelling clays, lost circulation)

5. Protection of the integrity of the conductor boring, pilot and reamed boreholes during drilling and well construction operations

6. Complete and accurate geophysical logging of the boreholes

During the drilling of the pilot borehole and reamed borehole, and the installation of the well casing, screen, and annular materials, the Contractor will be responsible to minimize the chemical and biological disturbance of the vadose zone and saturated alluvial matrix. The use of organic drilling fluid materials (such as starch, guar, or cottonseed hulls) will not be accepted for drilling. Safety Data Sheets (SDSs) from the manufacturer for all drilling fluid additives must be provided to the Consultant for review and approval prior to their use. Consultant reserves the right to reject any and all proposed additives.

3.2 Make-up Water

The Contractor shall take all necessary precautions to ensure that chemical quality of the construction water is not impaired during transport from the source area to the storage area or well site. The Contractor shall provide the Owner the ability to obtain samples of the construction water for laboratory chemical analyses to ensure that no contaminants are present and that the water is suitable for drilling and construction of the well. The makeup water shall be reviewed and approved by the Consultant prior to use.

3.3 Drilling Fluid Control Plan

The Contractor shall provide a drilling fluid control plan to the Consultant prior to the start of drilling. The plan will outline specific drilling fluid additives the Contractor plans to use, how anticipated changes in the drilling conditions will affect the drilling fluid control plan, fluid testing procedures, and equipment that will be used. Consultant must approve the drilling fluid control plan. Drilling

fluid additives shall be certified by the National Sanitation Foundation (NSF) and approved by the Consultant prior to use.

3.4 Drilling Fluid Testing

The Contractor shall retain qualified and experienced Drilling Fluid personnel. The Contractor's selection of Drilling Fluid personnel will be subject to review and approval by the Consultant. The Drilling Fluid personnel will be available within a 2-hour travel time of the site during all drilling and well construction operations.

Drilling fluid tests shall be performed by Drilling Fluid personnel during periods when any drilling fluid additives (not only clear water) are being circulated in the borehole. Physical and chemical properties of the drilling fluid are to be measured in accordance with the procedures of the American Petroleum Institute (API) Standard RP 13B, "Standard Procedures for Testing Drilling Fluids". Samples tested are those collected at the drilling rig discharge line, with care taken to assure a true and representative sample is collected. Drilling fluid tests shall be conducted by the Drilling Fluid personnel at a minimum of 1) every four (4) circulating hours, 2) when significant changes to the drilling fluid are made, 3) whenever conditions appear to have changed, 4) when problems arise, or 5) at the request of the Consultant.

The Contractor shall have an Imhoff Cone, Marsh-type viscosity funnel, and a mud scale at the site and, upon request, will be made available to the Consultant.

The Contractor shall maintain current records at the well site at all times to show: 1) the time, depth, and results of all drilling fluid tests, 2) all materials added to the system, (i.e., kind, amount, time, and depth), and 3) variances or modifications from the agreed-upon fluid program, such as time, depth, reason, and authorization.

The Contractor is responsible for maintaining an adequate supply of drilling fluid additives at the drilling site and for the removal of all drilling fluids and additives from the borehole during development of the well.

3.5 Drilling Fluid Reconditioning

In accordance with applicable provisions of the American National Standards Institute (ANSI)/American Water Works Association (AWWA) A100-20 for water wells, these specifications, or at the direction of the Consultant, the drilling fluid shall be reconditioned prior to the installation of the filter pack, until it has the following properties.

1. Weight: 8.7 to 9.2 pounds per gallon (lb./gal), not to exceed 9.4 lb./gal.
2. Maximum Marsh Funnel Viscosity: 38 seconds per quart;
3. Maximum 30-Minute Water Loss: 15 cubic centimeters;
4. Maximum Filter Cake: 3/32-inch;

5. Maximum Sand Content Entering Borehole: 2 percent by volume;

6. Maximum Total Solids Content: 8 percent; and

7. pH: 8.0 – 9.0 pH units

At the discretion of the Consultant, the above standards may be exceeded in cases where different drilling fluid properties are required to protect or stabilize the well due to unstable borehole conditions, or other site-specific circumstances. The Contractor shall adhere to the standards listed above, unless otherwise approved by the Consultant.

3.6 Drilling Fluid Additives

Drilling fluid additives, if used, may include:

1. Baroid Industrial Drilling Products Aquagel, Quik-Gel, or other high-grade National Science Foundation (NSF)-certified biodegradable chemical products;

2. Drispac Super Low Polyanionic Cellulose Polymer;

3. Polymers; and

4. Bentonite;

Drilling fluid additives shall be delivered to the well site in factory labeled and sealed containers for Consultant's inspection prior to use. The Contractor shall also provide Safety Data Sheets (SDS)' for all drilling fluid additives to the Consultant and Owner for review and approval prior to use.

3.7 Mud Pit

The drilling fluids and drill cuttings shall be contained at the site in above ground mud pits to be provided by the Contractor. The mud pits shall have a minimum depth of four (4) feet and a total volume no less than that of the reamed borehole. The mud pits shall contain at least one baffle, to assist with the separation of cuttings and suspended solids from the drilling fluid. All drill cuttings will be placed in temporary containment and later disposal at a designated on-site location.

3.7 Lost Circulation

Lost circulation is a loss of drilling fluid to the formation that exceeds the maximum available discharge rate of water into the borehole, to the extent that the fluid level in the annulus outside the drill pipe cannot be maintained to a level above the base of the surface casing for at least one (1) hour.

During pilot borehole drilling or reaming operations, if lost circulation occurs at no fault to the Contractor the Owner will compensate the Contractor. If circulation is lost due to the actions of the Contractor (e.g., excessive fluid weight) then the Contractor shall regain circulation at no cost to the Owner.

The Contractor is responsible to notify Consultant and Owner immediately upon each occurrence of lost circulation and to document the times, quantities, and circumstances of lost circulation during each occurrence. Failure of the Contractor to promptly notify Consultant and Owner of lost circulation will void the Contractor's opportunity to implement this clause but will not affect the Contractor's responsibility to maintain the integrity of the borehole.

The conditions of this Section shall apply from the beginning of the period of lost circulation and shall continue only until such time that the drilling fluid level can be maintained within the surface casing. After an initial lost circulation event has occurred, should circulation be lost again, the conditions of this paragraph will go into effect immediately, and continue until such time as drilling fluid circulation is regained.

3.8 Submittals

A. Drilling Fluid Log. During the drilling of the borehole, the Contractor shall log the drilling fluid properties. The drilling fluid properties shall be recorded on an API approved form. The drilling fluid records shall be available for review by the Consultant. The drilling fluid log shall be submitted to Consultant and Owner upon completion of each day's work activities.

B. Drilling Fluid Control Plan.

C. SDS' from the manufacturer for all drilling fluid additives must be provided to the Consultant for review and approval prior to their use.

D. The specific dimensions and design of the mud pits must be approved by the Consultant.

3.9 Measurements and Payments

Full compensation for complying with the requirements of Section 3.0 pertaining to drilling fluids shall be made at the lump sum price for "Mobilization and Demobilization", described in Bid Schedules, and no additional compensation will be allowed.

***** End of Section *****

4.0 Furnish and Install Conductor Casing and Surface Seal

4.1 Conductor Borehole Drilling

The conductor casing borehole may be drilled using the rotary or bucket auger (solid stem auger) drilling method. The borehole shall be drilled to a minimum 48-inch diameter and to a minimum depth of 40 feet or as directed by the Consultant.

4.2 Plumbness and Alignment

The borehole shall be sufficiently straight and plumb as to allow for the unobstructed installation of the conductor casing and the uniform placement of the sand cement grout surface seal.

The conductor casing shall be sufficiently straight and plumb as to allow for the uniform placement of the sand cement grout seal and to allow for the unobstructed drilling of the pilot hole, reaming of the pilot hole and installation of the well casing.

Consultant shall review and determine compliance with the plumbness and alignment requirements. If the borehole or conductor casing fails to meet the plumbness and alignment requirements the Contractor must correct the plumbness and alignment to the satisfaction and approval of the Consultant and the Owner. Plumbness and alignment correction costs will be borne by the Contractor.

4.3 Drill Cuttings

During the drilling of the conductor borehole the Contractor shall collect and preserve two (2) unwashed samples of the drill cuttings at ten (10)-foot depth intervals. The two samples shall be placed in minimum quart-sized re-sealable plastic bags (e.g., Ziploc) clearly labeled with the following: Well ID, sample depth (in feet below ground surface, bgs), sample date and time. At the completion of the conductor borehole drilling the Contractor shall provide the soil samples to the Consultant. The remaining drill cuttings shall be placed in soil roll-off bins unless otherwise approved by the Owner.

4.4 Conductor Casing Materials

The conductor casing shall be new low carbon steel (LCS) and manufactured in accordance with American Society for Testing and Materials (ASTM) Specification A53 Grade B steel or ASTM Specification A139 Grade B steel and be free from any material defects. The surface casing shall be 41-feet long, 36-inch outside diameter, and have a minimum 0.375-inch (3/8-inch) wall thickness.

4.5 Cement Grout Seal Materials

The following materials are acceptable for the sealing of the conductor casing.

1. Sand Cement

2. Neat Cement

Sand cement grout seal material shall consist of cement slurry containing six (6) gallons of clean water per 94-pound sack of Portland cement. The Portland cement shall conform to ASTM Standard C150, Type I or II. The cement shall be mixed with no more than 50% sand by volume or one part sand to two parts cement by weight and in accordance with AAC Rule 12-15-801. The sand cement grout shall be free of lumps to the satisfaction of the Consultant. Water used for preparing the cement grout shall be potable. Bentonite and accelerator additives, such as calcium chloride, shall not be used.

The Contractor must provide a cement mix design, the mix water source, and the specific constituents of the cement grout to the Consultant for approval prior to the installation of the sand cement grout.

The neat cement shall consist of a cement slurry containing 5 to 6 gallons of water per 94-pound sack of Portland cement. The Portland cement shall conform to ASTM Standard C150, Type I or II and shall be free of lumps, to the satisfaction of the Consultant. Water used for preparing the cement grout shall be potable. The neat cement grout slurry may not contain pozzolanic (fly ash) or non-pozzolanic aggregate, sand, or accelerator additives, unless approved by the Consultant.

The Contractor shall provide a copy of the cement weigh ticket for every truckload of sand cement grout or neat cement grout delivered to the site for review and approval prior to installation. Cement grout that does not comply with the above requirements as determined by the Consultant will be rejected.

The cement grout shall be placed in the annular space between the borehole wall and the conductor casing using a tremie set to within 5 (five) feet of the bottom of the borehole. Cement grout shall then be pumped into the tremie and placed in the annular space under pressure until the cement grout reaches to within one (1) foot of the ground surface. Once cement grout has been placed to the desired depth as determined by the Consultant, the tremie shall be removed from the annular space.

4.6 Conductor Casing Installation

The conductor casing shall be placed from one (1) foot above the ground surface to at least 40 feet below the ground surface (ft bgs). The Contractor shall notify Consultant at least one week before conductor casing installation and shall install conductor casing under the Consultant's supervision, unless otherwise approved by the Consultant.

4.7 Cement Grout Seal Installation

The installation of the cement grout seal shall be conducted under the observation of the Consultant, unless otherwise approved, and placed in the annular space between the well casing and the wall of the conductor borehole from the base of the conductor casing to the ground surface. The Contractor shall be responsible to maintain an equalization of pressures to the extent necessary to prevent collapse of the conductor casing during cement grout installation. The grout seal shall

completely fill the annular space and form a uniform continuous seal between the surface casing and the wall of the borehole.

The conductor casing shall be maintained centered in the borehole during and after cement grout installation. Consultant must approve the method of grout installation. A minimum curing time for the conductor casing cement grout seal is 24 hours, with the cement grout obtaining a compressive strength of at least 500 pounds per square inch (psi).

4.8 Submittals

A. The Contractor shall submit the required drill cuttings to the Consultant.

B. Prior to the installation of the conductor casing, the Contractor shall submit a certified test report to the Consultant demonstrating compliance with the physical and chemical properties of the conductor casing.

C. The cement grout must be approved by the Consultant prior to installation.

D. Consultant must approve the method of the surface seal installation.

E. Upon delivery of each truckload of cement grout and prior to the installation of cement grout the Contractor shall provide one (1) copy of the weigh ticket to the Consultant for review and approval.

4.9 Measurements and Payments

Full compensation for complying with the requirements of Section 4.0 pertaining to furnishing and installing the conductor casing and sanitary seal shall be made at the unit price per lineal foot for “Furnish and Install Conductor Casing and Surface Seal”, described in Bid Schedule, and no additional compensation will be allowed.

***** End of Section *****

5.0 Pilot Hole and Reamed Pilot Hole Drilling

5.1 Equipment

The Contractor shall furnish and maintain in safe and efficient working condition all equipment necessary to perform the work. This shall include a drilling rig capable of performing the specified operations to the specified depths and auxiliary equipment as specified or required to complete the work. The drilling rig shall be capable of drilling to a depth of 700-1,000 feet bgs or to a maximum depth of 1,200 feet bgs, for a deep well option.

The Contractor shall submit a statement indicating the drilling equipment to be used. The drilling rig used for the installation of the production well shall have a mast capacity no less than 1½ times the string weight of the well casing and perforated well casing. Additionally, the well shall be installed without the use of a float plate. The drill pipe shall have a minimum 5½-inch inside diameter (ID).

The equipment supplied by the Contractor shall include, but not be limited to, the following.

1 A wire line depth indicator capable of measuring depths equal to the total depth of the borehole, and equipped with a counter device which provides for a depth measurement accuracy of ± 1 foot

2 A water level sounder that provides for a depth measurement accuracy of ± 0.1 foot

3 Standard API drilling fluid measuring devises to measure the following properties: mud viscosity, mud weight, sand content and water loss

4 An operating and accurate 3-degree inclinometer tool

5 An operating and accurate penetration rate indicator (Geolograph or approved equal)

6 An operating and accurate gauge that indicates the hook load (weight) of the drill string

The Contractor shall also maintain at the well, or have the ability to rapidly fabricate, commonly used fishing tools (such as overshots, wall hooks, junk baskets, etc.) to accommodate the event that lost tools in the borehole require fishing operations. The Contractor shall be responsible for any and all lost tools and equipment and for the use of fishing tools to extract lost equipment and tools from the pilot hole, reamed pilot hole and/or well. All costs associated with lost equipment or tools and/or their retrieval with fishing tools shall be borne by the Contractor.

The drilling rig and auxiliary equipment shall be well maintained and shall meet the standards of the Occupational Safety and Health Administration (OSHA). Rig walkways and stairways shall be guarded with rails, and Contractor personnel shall use a safety harness at all times when ascending the rig mast. All high-pressure hoses shall be equipped with a safety chain to protect against the event of hose failure.

Prior to the start of drilling, the Contractor shall decontaminate the drill rig and downhole tools by steam cleaning. The method and extent of steam cleaning must be approved by the Consultant. The Contractor will be required to provide a letter of certification of the decontamination of the Contractor's equipment, prior to utilization. The Contractor may certify, in writing, the decontamination of critical (downhole) pieces of drilling equipment in lieu of actual steam cleaning, provided the downhole pieces of drilling equipment have not been in contact with any hazardous or toxic materials since the last decontamination. All necessary steam cleaning will be conducted at the Contractor's expense.

5.2 Plumbness and Alignment

The plumbness and alignment of the pilot borehole and reamed borehole shall allow for the installation of a well that complies with ANSI/AWWA A100-20, where the maximum allowable horizontal deviation (drift) of the completed well casing from vertical shall not exceed 0.0067 times the smallest inside diameter of that part of the well being tested per foot of depth.

A magnetic deviation survey or gyroscopic survey shall be conducted after the completion of the pilot borehole and reamed borehole drilling to determine compliance with the plumbness and alignment requirements.

If the boreholes fail to meet the plumbness and alignment requirements, as determined by the magnetic deviation survey or gyroscopic survey, the Contractor must correct the plumbness and alignment to the satisfaction and approval of the Consultant and Owner. Plumbness and alignment correction costs will be borne by the Contractor.

5.3 Low Penetration

Low penetration is defined as a drilling rate of less than 2.0 feet per hour for a period of two (2) continuous hours, while at least 1,500 pounds per diameter inch is applied to the drill bit and the drill bit is in good working condition.

The Contractor shall notify the Consultant within one (1) hour of the following drilling condition: a penetration rate of less than 2.0 feet per hour for a period of two (2) continuous hours, while at least 1,500 pounds per diameter inch is applied to the drill bit.

Under the conditions cited above and at the request of the Consultant, the Contractor shall trip the drill string out of the hole for inspection of the drill bit by the Consultant and the Contractor.

If the Consultant 1) was notified as outlined above and 2) determines that there is no excessive bit wear then the Contractor shall be compensated on an hourly basis for low penetration conditions and for the time expended to remove and re-install the drill bit.

If the Consultant was not notified, as outlined above, or if the Consultant determines that there is excessive bit wear then this Section will not apply.

5.4 Pilot Hole Drilling

After the completion of the conductor casing, the pilot borehole shall be drilled to the depth noted on the Preliminary Well Design (Figure 2) and shall have a diameter of 17.5 inches unless otherwise approved by the Consultant. The borehole shall be drilled in compliance with the drilling fluid requirements as specified above. During the drilling of the pilot hole, all operations shall be conducted on a 24-hour per day, 7-day per week basis.

As an indication of the plumbness and alignment and not a determination of the plumbness and alignment, the Contractor shall conduct an inclinometer survey during the drilling of the pilot borehole using an inclinometer (TOTCO tool or approved equal) at 100-foot depth intervals. A 3-degree unit shall be used with the inclinometer. The inclinometer results shall be provided by the Contractor to the Consultant.

5.5 Reamed Pilot Hole Drilling

After the completion of pilot hole geophysical logging and deviation survey as described in Section 6, the pilot hole shall be reamed to a diameter with a minimum of 30”-34” inches depending on casing design, from 40 feet bgs to maximum depth of the deep well option. A Preliminary Well Design shall be submitted for approval by RID. The reamed pilot hole shall be drilled in compliance with the drilling fluid requirements specified above. During drilling of the reamed pilot hole, all operations shall be conducted on a 24-hour per day, 7-day per week basis.

5.7 Drill Cuttings

During the drilling of the pilot the Contractor shall collect and preserve a one (1) quart and minimum one- pound unwashed sample of the drill cuttings at ten (10) foot intervals and at every change in formation for inspection by the Consultant.

The Contractor shall provide an acceptable means of sampling the drilled cuttings at the discharge pipe. A sump-type or baffle-type sample catching device shall be provided by the Contractor. Each drill cutting sample shall be carefully collected from the sampling point, and the sample catching device shall be cleaned of all cuttings after each sample is taken.

The sample shall be placed in a sample storage area on a plastic tarp at least 6 mils thick. The storage area and plastic tarp must allow samples to be maintained in sequence and unmixed with surface material or other samples until they have been examined and logged by the Consultant. During times of inclement weather, the samples shall be covered with a plastic tarp at least 6 mils thick.

Each sample shall be laid out in descending order and labeled as follows: Well ID, sample depth range (in feet bgs), sample date and time.

Prior to the start of drilling, the Contractor shall submit details of the proposed formation sampling method to the Consultant, including the specific sampling equipment to be used (e.g., sample collection box). The sampling program and equipment must be approved by the Consultant.

5.8 Reports, Logs and Records

The Contractor shall keep an accurate and legible daily log and record of all drilling, testing, and construction, describing all geologic material encountered during drilling, the depths at which changes in formation occur, and all difficulties or unusual conditions encountered.

5.9 Penetration Rate Log

During the drilling of the pilot hole, a time log shall be kept showing the actual penetration time required to drill each foot of the borehole. Every foot drilled shall be clearly marked on a Geolograph strip chart. The types of bits used in each interval of the borehole shall be noted on this log and whether designed for soft, medium, or hard formations, including approximate weight on the bit, the rotation speed (RPM) of the bit, and any other information that may be requested by the Consultant. These logs shall be available for review by the Consultant throughout the drilling program, and a copy of the log shall be delivered to the Consultant daily.

5.10 Well Driller Report and Well Log

During the drilling of the pilot hole, the Contractor shall prepare a Well Driller Report and Well Log in compliance with the requirements of ADWR Form 55-55 as described in ARS 45-600 and AAC Rule 12-15-808. The log shall include the reference point for all depth measurements, a generalized description of each formation, the depth at which each formation is encountered, and the thickness of each formation. The lithologic log prepared by the Consultant will be made available to the Contractor to assist in the preparation of the Well Driller Report and Well Log. A copy of the Well Driller Report and Well Log shall be submitted to the Consultant and Owner.

5.11 Submittals

A. Prior to the start of drilling, the Contractor shall provide a letter of certification of the decontamination of the Contractor's equipment, prior to utilization.

B. Formation Sampling Plan

C. Driller's Log

D. Penetration Rate Log

E. Statement of the drilling rig to be used and the mast capacity

F. Inclinometer survey results

5.12 Measurements and Payments

Full compensation for complying with the requirements of Section 5.0 pertaining to pilot borehole drilling shall be made at the unit price per lineal foot for “Drill Minimum 17.5-Inch Pilot Hole”, described in Bid Schedule, and no additional compensation will be allowed. Full compensation for complying with the requirements of Section 5.0 pertaining to pilot hole reaming shall be made at the unit price per lineal foot for “Ream Pilot Hole”, described in Bid Schedule, and no additional compensation will be allowed.

***** End of Section *****

6.0 Pilot Hole Geophysical Logging

6.1 General

Geophysical logging of the total depth of the pilot hole shall be conducted at the completion of the pilot hole drilling. The Contractor shall retain a geophysical logging company as a Subcontractor. Consultant shall review and approve the Geophysical Logging Subcontractor prior to the start of logging. All geophysical logging activities shall be conducted under the observation of the Consultant, unless otherwise approved. The geophysical logging suite for the borehole shall include the following.

1 Spontaneous Potential Log,

2 Short Normal and Long Normal Resistivity Log (16- and 64-inch spacing),

3 Single Point Resistivity Log,

4 Gamma Log,

5 Laterolog 3 Resistivity

6 Sonic Velocity Log

7 Gyroscopic Survey

The Contractor shall recondition the drilling fluid prior to the geophysical logging and shall keep the borehole full of drilling fluid at all times during geophysical logging, to stabilize the borehole and provide log integrity. The Contractor shall assist the geophysical logging subcontractor in rigging of the geophysical survey equipment. The Contractor shall ensure that the logging tools can be run to the total depth of the pilot hole without interference by obstructions or tight sections in the borehole.

At the request of the Consultant, the geophysical logging subcontractor shall conduct repeat sections of geophysical logs in intervals of the borehole selected by the Consultant. The repeat logging intervals will not exceed 50 feet.

The magnetic deviation log or gyroscopic survey shall be used to determine the conformance of the pilot hole to the plumbness and alignment requirements. The geophysical logging subcontractor shall prepare a written plumbness and alignment report. The report shall include numerical values of the well deviation and also graphical diagrams of the well alignment, from both a profile perspective (both Northing and Easting views), and a vertical perspective. The quality and clarity of the gyroscopic logs shall be approved by the Consultant.

6.2 Submittals

A. The Contractor shall submit to the Consultant and Owner for review and approval the name and contact information for the geophysical logging subcontractor.

B. The geophysical logging subcontractor shall provide two (2) field copies of each geophysical log survey to Consultant and Owner upon the completion of logging. The geophysical logging subcontractor shall within 48 hours after completing the gyroscopic survey provide Consultant and Owner with two (2) final copies of the gyroscopic survey, plumbness and alignment report; one (1) electronic copy of the gyroscopic survey in a PDF format, and one (1) electronic copy of the plumbness and alignment report in a PDF format. Logs must be presented in American Petroleum Institute (API) format; vertical scale of 1-inch equals 50 linear and logarithmic plots.

6.3 Measurements and Payments

Full compensation for complying with the requirements of Section 6.0 pertaining to pilot hole geophysical logging shall be made at the unit price per lineal foot for “Pilot Hole Geophysical Logging”, described in Bid Schedule, and no additional compensation will be allowed.

***** End of Section *****

***** End of Section*****

8.0 Reamed Pilot Hole Geophysical Logging

8.1 General

After the completion of the pilot hole reaming, the Contractor shall conduct the following geophysical logs of the borehole.

1. Gyroscopic Survey

2. Caliper Log

The Contractor shall notify Consultant prior to geophysical surveys and Consultant reserves the right to review and approve the geophysical logging subcontractor prior to the start of logging.

The Contractor shall keep the reamed pilot hole full of drilling fluid at all times during geophysical logging, to stabilize the borehole and provide log integrity. The Contractor shall assist the geophysical logging subcontractor in rigging of the geophysical survey equipment. The Contractor shall ensure that the logging tools can be run to the total depth of the reamed borehole without interference by obstructions or tight sections in the borehole.

8.2 Gyroscopic Survey

The gyroscopic survey tool shall be centralized in the well and at the request of the Consultant, the geophysical logging subcontractor shall conduct repeat sections of the gyroscopic survey tool in intervals of the borehole selected by the Consultant. The repeat logging intervals will not exceed 50 feet.

The gyroscopic survey shall be used to support a determination by the Consultant, of the conformance of the reamed borehole to the plumbness and alignment requirements. The geophysical logging subcontractor shall prepare a written plumbness and alignment report. The report shall include numerical values of the well deviation and graphical diagrams of the well alignment, from both a profile perspective (both Northing and Easting views), and a vertical perspective. The quality and clarity of the gyroscopic survey must be approved by the Consultant.

8.3 Caliper Log

Upon completion of the gyroscopic survey, the Contractor shall run a caliper log as specified to determine uniformity of the borehole diameter. If the caliper log shows the borehole at any point to be less than the specified diameter and alignment, the hole shall be reamed and logged again, at the Contractor's expense.

The caliper logging tool shall be centralized in the reamed pilot hole and at the request of the Consultant, the geophysical logging subcontractor shall conduct repeat sections of the caliper

logging tool in intervals of the borehole selected by the Consultant. The repeat logging intervals will not exceed 50 feet.

The caliper log report shall graphically show the measured diameter of the reamed borehole from the top of the conductor casing to the bottom of the borehole. The report shall also show annular volume calculations to be used for the installation of gravel pack and annular materials.

8.4 Submittals

A. The Contractor shall submit to the Consultant and Owner for review and approval the name and contact information for the geophysical logging subcontractor.

B. The geophysical logging subcontractor shall upon completion of the caliper log and gyroscopic survey provide Consultant with two (2) field copies of the gyroscopic survey, plumbness and alignment report and caliper log. Within 48 hours after completion of the caliper log and gyroscopic survey, the geophysical logging subcontractor shall provide to Consultant and Owner two (2) final copies of the gyroscopic survey, one (1) electronic copy of the gyroscopic survey in a PDF format, and one (1) electronic copy of the plumbness and alignment report in PDF format. Logs must be presented in API format; vertical scale of 1-inch equals 50 feet on linear and logarithmic plots.

8.5 Measurements and Payments

Full compensation for complying with the requirements of Section 8.0 pertaining to reamed pilot hole geophysical logging shall be made at the lump sum price for “Reamed Pilot Hole Geophysical Logging”, described in Bid Schedule, and no additional compensation will be allowed.

***** End of Section *****

9.0 Furnish and Install Well Construction Materials

9.1 General

The well blank casing, perforated casing, water level sounding tube and gravel feed tube, and annular materials for the well must be approved by Consultant and Owner prior to installation.

Consultant and Owner will make a final determination of the perforated casing slot size and the final length and depths of the well casing, perforated casing, water level sounding tube and gravel feed tube based on analysis of the lithologic log, geophysical logging data and other sampling data, from the pilot hole.

The Contractor shall immediately commence well construction operations after completion of the caliper log and gyroscopic survey.

9.2 Well Casing, Water Level Sounding Tube and Gravel Feed Tube Material

The well casing, water level sounding tube and gravel feed tube shall be new and shall meet the requirements listed below.

Description	Steel	Outside Diameter (inches)	Wall Thickness (inch)	Section Length 700-1,000 - Foot BGS (feet)
Well Casing	ASTM 139 Grade B (LCS),	20.750	0.375 (3/8)	Per Diagram
Water Level Sounding Tube	ASTM A53 Grade B (LCS)	2.5	Schedule 40	Per Diagram
Gravel Feed Tube	ASTM A53 Grade B (LCS)	3.5	Schedule 40	Per Diagram

The casing sections shall contain one spiral seam along the casing axis and shall contain no more than one circumferential seam per 10 linear feet, unless otherwise approved by Consultant and Owner. The casing shall be marked in accordance with these standards. The well casing shall be factory-assembled.

The Contractor shall obtain from the well casing manufacturer, the tensile strength (pounds), collapse strength (psi), weight (pounds per linear foot), and maximum recommended hang weight (pounds) of the casing. This information shall be provided to Consultant and Owner prior to delivery of the casing to the site.

Prior to casing installation, the Contractor shall submit certified test reports to Consultant and Owner from the well casing, water level sounding tube and gravel feed tube manufacturer(s) to demonstrate compliance with the physical and chemical properties of the well casing, water level sounding tube and gravel feed tube that are specified herein.

9.3 Perforated Casing Material

The perforated casing for the agricultural well shall be new ASTM A139 Grade B Low Carbon Steel (LCS) with vertical Mill Slot perforations. Per Replacement Well Design Figures Depending on the final casing design, The aperture in the perforated casing shall be machine made. The perforation design is as indicated above is for bidding purposes and is subject to change based on actual geologic conditions encountered during pilot hole drilling.

The Contractor shall obtain from the perforated casing manufacturer, the tensile strength (pounds), collapse strength (psi), weight (pounds per linear foot), and maximum recommended hang weight (pounds) of the perforated casing. This information shall be provided to Consultant and Owner prior to delivery of the perforated casing to the site.

Prior to perforated casing installation, the Contractor shall submit certified test reports to Consultant and Owner from the perforated casing manufacturer to demonstrate compliance with the physical and chemical properties of the perforated casing that are specified herein.

9.4 Welding Collars and Centralizers

The welding collars and centralizers shall be new and shall meet the requirements listed below. The welding collars shall fit the outside diameter of the blank well casing and perforated casing within 0.0625-inch diametrical clearance. The welding collars shall be delivered to the well site connected to the casing sections at one end with factory-welded connections. The inside edge of the welding collars shall be ground or sufficiently scarified to remove sharp edges or burrs. Three alignment holes shall be provided in each welding collar (spaced at 120°), to ensure proper abutment of the casing sections. The alignment holes shall be no larger than 1 inch in diameter and shall be completely filled with fillet welding.

Three steel guides (centralizers), attached to the casing at intervals of not more than 50 feet shall be provided in order to center and hold the well casing and perforated casing in its proper position until the gravel pack is in place.

Centralizers shall also be installed 5 feet from the top and bottom of the well casing. The bottom of the well casing shall be at a sufficient distance above the bottom of the reamed borehole (ten-feet

minimum) as to ensure that none of the casing will be supported from the bottom of the hole. The centralizers shall be welded at both points that contact the casing.

Centralizers shall be constructed of 3/8-inch-thick steel strips at least 2 inches wide. Each strip shall provide at least one-foot length of bearing surface at the bore interface. At least three strips shall be provided at each centralizer location at approximately 120 degrees apart. Centralizer strips shall be placed on the same vertical alignment to facilitate tremie placement for installation of the gravel pack and annular materials.

Description	Steel	Wall Thickness	Length
Welding Collars	ASTM A139Grade B (LCS)	.312-inch	5-inches
Centralizers	ASTM A139 Grade B (LCS)	---	---

9.5 Gravel Pack Material

The gravel pack shall be Tacna Sand & Gravel, LLC (Tacna) sand or approved equal, consisting of clean, well-rounded grains that are smooth and uniform. The gravel pack shall be siliceous with a limit of 2 percent, by weight, calcareous material. The gravel pack material shall be obtained from a source that has been approved by Consultant and Owner and shall consist of well-rounded particles with an average density of not less than 2.5 grams per cubic centimeter and have a uniformity coefficient no greater than 2.5. Not more than 1 percent, by weight, of the material shall have a density of 2.25 grams per cubic centimeter or less. The gravel pack shall contain no more than 2 percent by weight, thin, flat, or elongated pieces (pieces in which the largest dimension exceeds three times the smallest dimension) determined by hand-packing. The gravel pack material shall be free of shale, mica, clay, dirt, loam, organic impurities of any kind, and shall not contain iron or manganese in a form or quantity that will adversely affect the water quality.

Samples of the gravel pack sand and a sieve analysis (percent retained through U.S. standard sieve numbers 4, 8, 10, 12, 14, 16, 20, 30, and 200) of the gravel pack material shall be submitted to the Consultant for approval, a minimum of three (3) days prior to delivery of the gravel pack to the well site. The gravel pack material shall be contained in a laydown area at the well site in such a manner as to prevent contamination. The gravel pack material shall be bagged in approximately 3,000-pound (about one cubic yard) “super sacks”. Each bag must be labeled with its actual weight, name of manufacturer and manufacturer’s identification and gradation (e.g., Tacna 6 x 16), but consistent with gravel pack samples submitted with sieve analyses and for pre-delivery analysis by a third party. Any gravel pack material delivered un-bagged or unlabeled will be rejected. The gravel pack shall be Tacna 6 x 16 for bidding purposes and is subject to change based on actual geologic conditions encountered during pilot hole drilling.

9.6 Disinfectant Material

A liquid sodium hypochlorite solution or granular calcium hypochlorite in accordance with NSF 61 and AWWA Standard C654 for disinfection of wells shall be used.

9.7 Sand Cement Grout Seal Material

The sand cement grout seal material shall consist of cement slurry containing six (6) gallons of clean water per 94-pound sack of Portland cement. The Portland cement shall conform to ASTM Standard C150, Type I or II. The sand shall not exceed 188 pounds when mixed with one 94-pound bag of Portland cement (or two parts sand to one part cement, by weight). The cement shall be mixed with no more than 50% sand by volume or one part sand to two parts cement by weight and in accordance with AAC Rule 12-15-801. The sand cement grout shall be free of lumps to the satisfaction of the Consultant. Water used for preparing the cement grout shall be potable. Bentonite, and accelerator additives, such as calcium chloride, shall not be used.

The Contractor must provide a cement mix design, the mix water source, and the specific constituents of the cement grout to the Consultant for approval prior to the installation of the sand cement grout.

The Contractor shall provide a copy of the cement weigh ticket for every truckload of sand cement grout delivered to the site for review and approval prior to installation. Cement grout that does not comply with the above requirements as determined by the Consultant will be rejected.

9.8 Neat Cement Grout Seal Material

The neat cement shall consist of a cement slurry containing five (5) to six (6) gallons of water per 94-pound sack of Portland cement. The Portland cement shall conform to ASTM Standard C150, Type I or II and shall be free of lumps, to the satisfaction of the Consultant. Water used for preparing the cement grout shall be potable. The neat cement grout slurry may not contain pozzolanic (fly ash) or non-pozzolanic aggregate, sand, or accelerator additives, unless approved by the Consultant.

The Contractor must provide a cement mix design, the mix water source, and the specific constituents of the cement grout to the Consultant for approval prior to the installation of the cement grout.

The Contractor shall provide a copy of the cement weigh ticket for every truckload of neat cement grout delivered to the site for review and approval prior to installation. Cement grout that does not comply with the above requirements as determined by the Consultant will be rejected.

9.9 Furnish and Install Well Casing and Perforated Casing

During the installation of the well casing and perforated casing the borehole shall be kept full of drilling fluid and be free from any obstructions detrimental to completing the casing installation. The well casing shall be hung in tension throughout the installation of the annular materials. The well

casing shall be set centered in the hole so as not to interfere in any way with the installation of the annular materials. The Contractor will be required to work continuously, on a 24-hour per day, 7 day per week basis, while installing and completing the well.

The well casing and perforated casing shall be set by the Contractor at the depth intervals specified by the Consultant and approved by the Owner. The centralizers shall be secured to the well casing and perforated casing at intervals of not greater than 50 feet.

Joints in the well casing and perforated casing shall be field welded in accordance with applicable provisions of the AWWA Standard C206 for welded joints. The ends of each casing section shall not vary more than 0.010 inch at any point from a true plane at right angles to the axis of the casing. A welding sequence shall be followed that will avoid excessive distortion, voids, and/or air pockets. All well casing joints or overlaps shall be made watertight. All welding shall be performed by an experienced welder.

If the well casing or perforated casing sections are butt-welded without the use of welding rings, the ends of the casing lengths shall be ground, or sufficiently scarified, to remove sharp edges or burrs. Each well casing and perforated casing end shall be beveled at one end to allow complete penetration of the welds.

If the well casing or perforated casing sections are joined with welding rings, the ends of the casing lengths shall be ground, or sufficiently scarified, to remove sharp edges or burrs. One end of each casing section shall be furnished with a welding collar.

9.10 Furnish and Install Gravel Pack and Disinfectant

Prior to the installation of the gravel pack and disinfectant, the Contractor shall recondition the drilling fluid. The gravel pack shall be placed to completely fill the annulus between the reamed borehole and the well casing.

The drilling fluid shall be maintained throughout the full depth of the well to the land surface and the well casing, gravel feed tube and perforated casing shall be maintained in tension, until the placement of the gravel pack has been completed to the specified level. During the time of placement, fluid circulation shall be maintained through a Consultant-approved swabbing tool located no less than 40-feet below the fill depth of the gravel pack. The swabbing tool shall be moved up and down in the well to enhance removal of fine-grained material, prevent bridging, and aid in settlement of the gravel pack in the borehole. Care shall be taken to avoid bridging during installation of the gravel pack.

The gravel pack and disinfectant shall be installed with potable water by use of a tremie pipe. At no time shall the bottom of the tremie pipe be located at a distance of greater than 30 feet above the interval being filled during gravel pack installation. The level of the gravel pack shall be measured periodically during installation with a wireline sounder, as required by the Consultant. Installation

of the gravel pack and disinfectant will be continuous, except when additional precautions are necessary to prevent bridging, or while measurement of the gravel pack level is being conducted.

The quantity of gravel pack material installed in the annulus shall not be less than that of the calculated volume as determined by the reamed borehole caliper survey. Upon completion of gravel pack installation, unused gravel pack material in excess of the annular gravel pack volume calculated from the caliper log will be judged an indication of voids in the gravel pack envelope and corrective measures shall be undertaken at the Contractor's expense. The specific method of gravel pack installation must be approved by the Consultant.

The gravel pack shall be disinfected using a Consultant-approved disinfectant that provides a chlorine residual of not less than 50 mg/l and no greater than 100 mg/l in the entire volume of the fluid within the well. The Contractor is responsible for the uniform application of the disinfecting agent throughout the gravel pack interval, without relying on subsequent mechanical surging action for dispersing the disinfectant. The specific method used to disinfect the gravel pack must be approved by the Consultant.

Prior to installation of the gravel pack and disinfectant, the Contractor shall submit an installation plan to the Consultant for review and approval. The plan shall include the proposed method to install the gravel pack and disinfectant.

9.11 Furnish and Install Neat Cement or Sand Cement Grout Annular Seal

The neat cement or sand cement grout seal shall be installed after the installation of the gravel pack. The cement grout seal shall be placed to completely fill the annular space between the well casing and the conductor casing. The well casing shall be hung in tension throughout the grouting operation, until the cement grout has cured sufficiently.

The cement grout shall be placed in several lifts from the bottom to the top of the interval to be grouted, forming a continuous seal. The neat cement grout, if used, shall be passed through a ½ inch slotted bar strainer to remove any unmixed lumps and installed by pumping through a tremie pipe. The discharge end of the tremie pipe shall be continuously submerged in the grout until the zone to be grouted is completely filled.

The Contractor is responsible to maintain cement slurry hydraulic pressures and pumping pressures that will not reach excessive levels and cause collapse of the well casing during the installation of the cement grout. The minimum curing time for the cement grout shall be 12 hours or the cement grout obtaining a minimum compressive strength of 500 psi.

9.12 Temporary Cover Plate and Water Level Access Port Installation

After completion of all testing and surveys, the Contractor shall install an access port and temporary cover plates on the well casing. The cover plate shall be tack welded to the top of the well casing. Additionally, the water level sounding tube and gravel feed tube access ports shall be completed with watertight threaded caps.

9.13 Submittals

A. The Contractor shall obtain from the well casing and perforated casing, water level sounding tube and gravel feed tube manufacturers, the tensile strength (pounds), collapse strength (psi), weight (pounds per linear foot), and maximum recommended hang weight (pounds). This information shall be provided to the Consultant prior to delivery of these materials to the site.

B. Prior to the installation of the well casing, perforated casing, water level sounding tube and gravel feed tube, the Contractor shall submit certified test reports to the Consultant and Owner to demonstrate compliance with the requirements of this section.

C. An affidavit of compliance with the welding provisions of this section shall be provided to the Consultant prior to the acceptance the well. The affidavit of compliance will certify that all welding was performed in accordance with all applicable requirements.

9.14 Measurements and Payments

Full compensation for complying with the requirements of Section 9.0 pertaining to the well casing including the 2.375-inch outside diameter (OD) Schedule 40 water level sounding tube will be made at the unit price per lineal foot for 20 or 24 -Inch OD LCSl Well Casing", described in Bid Schedule, and no additional compensation will be allowed. Full compensation for complying with the requirements of the perforated well casing shall be made at the unit price per lineal foot for "Furnish and Install 20 or 24.750-Inch OD LCS Vertical Mill Slotted Well Casing", described in Bid Schedule, and no additional compensation will be allowed. Full compensation for complying with the requirements of the water level sounding tube shall be made at the unit price per lineal foot for "Furnish and Install 2.375-Inch OD x Schedule 40 LCS Water Level Sounding Tube", described in Bid Schedule, and no additional compensation will be allowed.

Full compensation for complying with the requirements of Section 9.0 pertaining to the gravel feed tube shall be made at the unit price per lineal foot for "Furnish and Install 3.5-Inch OD x Schedule 40 LCS Gravel Feed Tube", described in Bid Schedule, and no additional compensation will be allowed.

Full compensation for complying with the requirements pertaining to the gravel pack shall be made at the unit price per lineal foot for "Furnish and Install Tacna 6 x 16 Gradation Gravel Pack", described in Bid Schedule, and no additional compensation will be allowed. Full compensation for complying with the requirements pertaining to the neat or sand cement annular seal shall be made at the unit price per lineal foot for "Furnish and Install Annular Seal", described in Bid Schedule, and no additional compensation will be allowed.

***** End of Section *****

10.0 Well Development

10.1 General

The Contractor shall develop the well after installation of the well casing, perforated casing, gravel feed tube, water level access port, and annual seal.

10.2 Equipment

The Contractor shall furnish and maintain in safe and efficient working condition all equipment necessary to perform and complete the well development. The equipment supplied by the Contractor shall include, but not limited to, the following:

A. Test motor,

B. Test Pump, to be set an approximate depth of 400 feet below top of casing,

C. Column pipe,

D. Discharge pipe, with appropriate fittings and couplings to RID canal or other as approved by RID.

E. Totalizing flowmeter, with totalizer reading in gallons and flowmeter reading in gpm, with most recent calibration certification available for review and approval by the Consultant.

F. Air compressor,

G. Tight-fitting dual swabbing tool,

H. A wire line capable of measuring the entire length of the well that provides for a depth measurement accuracy of ± 1 foot,

I. Generator,

J. Rossum sand tester,

K. Minimum 2.375” ID PVC water level sounding tube, for development by pumping and surging, and

L. Manifold piping, check valves and all other related equipment, materials, and labor necessary to conduct and complete development by pumping and surging.

For swabbing and airlifting, the air compressor shall be capable of supplying a minimum of 750 cubic feet per minute and 350 pounds per square inch and the airline shall have a minimum 1.5” inch ID to accommodate adequate airflow.

The equipment used for the addition of chemical additives must be approved by the Consultant.

Contractor shall also provide and install a Rossum Sand Tester in accordance with ANSI/AWWA A100-20 for measurement of sand production during development by pumping.

The Contractor shall furnish pumping equipment capable of developing the well during pumping and surging operations. The pump shall be capable of pumping a minimum of 300 gpm to 3,500 gpm for the 700-1,000 -foot bgs completed well with an approximate total dynamic head (TDH) of 450 feet and 530 feet, respectively, plus the head loss from the RID delivery pipe to the RID Canal. The pumping equipment shall be complete with an ample power source and shall be capable of being operated throughout the entire pumping and surging operations.

The discharge pipe shall be equipped with a Consultant-approved spigot or valve for water sample collection.

10.3 Dispersant Materials

At the Consultant's discretion and approval, a non-phosphate dispersant or surfactant that will not promote bacterial growth may be added to the well in accordance with the manufacturer's recommendations, during development operations to enhance the dispersing of fine-grained particles for removal during development operations. Examples of such materials include Johnson Screens Nu-Well 220 Dispersant Polymer or Baroid Aqua-Clear PFD Polymer Dispersant. The Contractor shall submit to the Consultant for review and approval any chemical dispersant to be used in the well. The Contractor shall provide the Consultant with a SDS and information related to NSF approval for all chemical additives used for well development at least three (3) days prior to their use. Consultant must approve the specific type and installation method of any chemical additives, if needed.

The specific methods, chemical additives, and equipment used for well development must be approved by the Consultant prior to commencement of development operations.

10.4 Development

The well shall first be developed using swabbing and airlifting followed by pumping and surging. The swabbing and airlifting shall include an initial quick downward swab followed by swabbing and airlifting starting at the bottom of the perforated well casing and shall proceed upward to the top of the perforated well casing, at a rate of no less than five (5) minutes per foot of perforated casing, unless otherwise directed by the Consultant. Additionally, a discharge rate of no less than 50 gpm must be maintained. Each section of perforated well casing shall be developed until that section is reasonably clear and free of sediment, as determined or approved by the Consultant.

After swabbing and airlift development and prior to development by pumping and surging, the top of the fill material in the well shall be measured. If more than five (5) feet of fill material is present in the well, as determined by the Consultant, then the fill material shall be removed from the well by airlifting or bailing prior to development by pumping and surging. In addition, upon completion of swabbing and airlift development and prior to development by pumping and surging, the gravel pack

level shall be measured and recorded. If additional gravel pack is required to re-fill the gravel feed tube, the date, time and quantity of gravel pack added shall be recorded.

Development by pumping and surging shall occur over a period of 120 hours at pumping rates ranging from 300 gpm to 3,500 gpm. The specific pump-and-surge development method must be approved by the Consultant. The well shall be developed by pumping and surging until the discharge is reasonably clear, that is turbidity is less than or equal to 10 NTU, and sand content, as measured with a Rossum sand tester, is less than or equal to five (5) parts per million (ppm) within 10 minutes after surging, by volume, as determined by the Consultant. After pumping and surging has been completed, the top of the fill material in the well shall be sounded. If more than five (5) feet of fill material is present in the well, as determined by the Consultant, the fill material shall be removed from the well prior to performance testing.

Water produced during well development will be discharged to RID canal or following decanting to reduce the solids discharged to the RID canal by the Contractor. Re-use of the discharge water will not be allowed without approval of the Consultant and Owener, with the exception of dust control, if necessary.

The Contractor shall furnish pumping equipment capable of variable pumping rates up to 3,500 gpm, with an approximate TDH of 450 feet plus the head loss from the RID delivery pipe to the RID Canal. The pumping equipment shall include satisfactory throttling devices or valves such that the discharge can be adjusted to various rates. The test pump setting shall be determined by the Consultant based on the final well design. The pumping units shall be complete with an ample power source and shall be capable of being operated without interruption for a minimum period of 24 hours.

The Contractor shall also furnish and install a 2.5 (2.5)-inch ID PVC water level sounding tube that extends from the top of the well casing to within five (5) feet of the top of the pump bowls to facilitate the measurement of water levels using an electric sounder. The bottom of the water level sounding tube shall be capped, with perforations in the lower 20 feet. The water level sounding tube shall permit the free and unobstructed passage of the electric sounder from the wellhead to the bottom of the water level sounding tube such that accurate water levels measurements can be obtained.

The discharge pipe shall be equipped with a Consultant-approved spigot or valve for water sample collection.

The Contractor shall also furnish equipment for measurement of the sand production during pumping. The sand measurement device shall be a Rossum sand tester in accordance with ANSI/AWWA A100-06.

The Contractor shall provide and install an approved in-line propeller or magnetic totalizing flow meter capable of accurately measuring the amount of water being discharged from the well. The in-line flow meter shall be located in a straight portion of the discharge pipe without any bends, valves, or other obstructions that may interfere with the operation and/or accuracy of the meter for a

distance of no less than 10 pipe diameters upstream, and for a distance of no less than five (5) pipe diameters downstream (unless otherwise recommended by the manufacturer of the meter). At all times during pumping, the discharge pipe shall be oriented in such a manner as to ensure that the pipe remains full of water at the location of the flow meter. Prior to the performance of development by pumping and surging activities, the Contractor shall provide written certification that the flow meter and totalizer are calibrated to within the accuracy constraints required by this specification.

10.5 Data Recording

The Contractor shall obtain and record the water level measurement, pumping rate, and total discharge volume in 15-minute intervals throughout the duration of development by pumping and surging, or as directed by the Consultant. The Contractor shall also measure and record sand content within 10 minutes after surging.

10.6 Submittals

A. The SDS' of all chemical additives to be used for well development shall be submitted to the Consultant for approval prior to commencement of development operations.

B. The design of the dual swab to be used for swab and airlift development shall be submitted to the Consultant for approval prior to commencement of development operations.

C. The method of pump and surge development shall be submitted to the Consultant for approval prior to pump and surge operations.

10.7 Measurements and Payments

Full compensation for complying with the requirements of Section 10.0 pertaining to development by swabbing and airlifting shall be made at the unit price for "Development by Swabbing and Airlifting", described in Bid Schedule, and no additional compensation will be allowed. Full compensation for complying with the requirements of Section 10.0 pertaining to development by pumping and surging shall be made at the unit price for "Development by Pumping and Surging", described in Bid Schedule, and no additional compensation will be allowed.

***** End of Section *****

11.0 Step-Drawdown and Constant Rate Pumping Tests

11.1 General

The Contractor shall conduct step-drawdown and constant rate pumping tests in the agricultural well after the completion of development.

11.2 Equipment

The Contractor shall furnish and maintain in safe and efficient working condition all equipment necessary to perform the step-drawdown and constant rate pumping tests. The equipment supplied by the Contractor shall include, but not limited to, the following:

A. Test motor,

B. Pump, to be set an approximate depth of 400 feet below top of casing, unless otherwise indicated by the Consulting pending final well construction,

C. Column pipe,

D. Discharge pipe to the nearby canal.

E. Totalizing flowmeter, with totalizer reading in gallons and flowmeter reading in gpm, with most recent calibration certification available for review and approval by the Consultant,

F. Water level sounder that provides for a depth measurement accuracy of ± 0.01 foot,

G. Minimum two and one-half (2.5)-inch ID PVC water level sounding tube,

H. Generator,

I. Rossum sand tester, and

J. Manifold piping, check valves and all other related equipment, materials, and labor necessary to conduct the step-drawdown and constant rate pumping tests.

The Contractor shall furnish pumping equipment capable of variable pumping rates from completed well and 300 gpm to 3,500 gpm, with an approximate TDH of 450 feet and 530 feet, respectively, plus the head loss from the RID delivery pipe to the RID Canal. The pumping equipment shall include satisfactory throttling devices or valves such that the discharge can be adjusted to various rates. The test pump setting shall be determined by the Consultant based on the final well design. The pumping units shall be complete with an ample power source and shall be capable of being operated without interruption for a period of 120 hours.

The Contractor shall also furnish and install a two and one-half (2.5)-inch inside diameter sounding tube that extends from the top of the well casing to approximately five (5) feet above the top of the pump bowls to facilitate the measurement of water levels using an electric sounder. The bottom of the sounding tube shall be capped, with perforations in the lower 20 feet. The sounding tube shall permit the free and unobstructed passage of the electric sounder from the wellhead to the bottom of the sounding tube such that accurate water levels measurements can be obtained.

The discharge pipe shall be equipped with a Consultant-approved spigot or valve for water sample collection.

The Contractor shall also furnish equipment for measurement of the sand production during pumping. The sand measurement device shall be a Rossum Sand Sampler in accordance with ANSI/AWWA A100-20.

The Contractor shall provide and install an approved in-line propeller or magnetic flow meter capable of accurately measuring the amount of water being discharged from the well to an accuracy of +/-2%. The in-line flow meter shall be located in a straight portion of the discharge pipe without any bends, valves, or other obstructions that may interfere with the operation and/or accuracy of the meter for a distance of no less than 10 pipe diameters upstream, and for a distance of no less than five (5) pipe diameters downstream (unless otherwise recommended by the manufacturer of the meter). At all times during pumping, the discharge pipe shall be oriented in such a manner as to ensure that the pipe remains full of water at the location of the flow meter. Prior to the performance of pumping activities, the Contractor shall provide written certification that flow meter and totalizer are calibrated to within +/-2% accuracy.

The equipment shall not be removed from the well until after the completion of the recovery test. Consultant must approve the test pump, motor, metering equipment, and accessories prior to installation.

11.3 Discharge

The Contractor shall operate the test pump at the discharge rates that have been directed by the Consultant and approved by the Owner. Discharge from the pump shall be controlled by a gate valve and/or engine throttle. The discharge shall be controlled and maintained at the specified rate for the entire test duration with an accuracy of plus-or-minus five (5) percent.

11.4 Data Recording

The Contractor shall obtain and record the water level measurement, discharge rate, and total discharge in 30-minute intervals throughout the duration of the aquifer testing, or as directed by the Consultant.

11.5 Step-Drawdown Test

The step-drawdown test shall have a 15-hour pumping duration consisting of five successively higher pumping rate steps of three (3)-hours each at 700, 1,400, 2,100, 2,800 and 3,500 gpm for the completed well. The Contractor shall monitor and adjust the pumping rate as directed by the Consultant to within 3% of the design pumping rate step. During the step-drawdown test the Consultant shall monitor and record water levels, pumping rates and total discharge.

11.6 Constant Rate Pumping Test

The constant rate pumping test shall consist of a 120-hour pumping duration. During the constant pumping rate test the Consultant shall monitor and record water levels, pumping rates, and total discharge. The Consultant and Owner reserves the right to adjust the test duration. The constant rate pumping test shall not begin for at least 12 hours after completion of the step-drawdown test or until groundwater levels have recovered to at least 90% of the pre-step-drawdown testing water level, whichever is greater.

11.7 Water Quality Sampling and Analysis

During the final hour of the 120-hour constant rate pumping test, groundwater samples from the discharge pipe sampling spigot shall be collected by the Contractor for complete irrigation analyses and submitted to a RID-approved analytical laboratory under standard chain of custody procedures. The groundwater samples shall be analyzed for and/or calculations made of the following:

Analyses

- Total Dissolved Solids, nitrate (as N) Arsenic, Fluoride, pH, Electrical Conductance, temperature

The Contractor shall coordinate with the RID-approved analytical laboratory for sample bottles, cold packs and ice chest for the storage and preservation of all samples collected. The groundwater samples shall be submitted to the analytical laboratory within all analytical holding times. The groundwater sample analytical report shall be submitted to RID upon receipt from the laboratory.

11.8 Recovery Test

The recovery test shall immediately follow the constant rate pumping test and shall last for a duration of up to 24-hours or 90% recovery, whichever is shorter. The Consultant shall monitor and record water level measurements throughout the duration of the recovery test.

11.9 Sand Production

The sand content in the first ten (10) minutes after the start of the constant rate test shall not exceed five (5) parts per million (ppm) by volume after one (1) hour of pumping.

If the well fails to meet the above requirements due to negligence on the part of the Contractor, the Contractor must correct the sand content to the satisfaction and approval of the Consultant and the Owner. To correct the sand content the Contractor may repeat the well development process. Sand content correction costs will be borne by the Contractor and at no cost to the Owner.

During the step-drawdown test the Contractor shall measure and record sand content in the first 10 minutes after the commencement of pumping and every 30 minutes thereafter after the commencement of each pumping rate step. During the constant rate pumping test the Contractor shall also measure and record the sand content in the first 10 minutes after the commencement of pumping and every 30 minutes thereafter.

11.10 Submittals

A. The Contractor shall submit to the Consultant for review and approval the test pump, motor, flow meter and totalizer, and accessories prior to commencement of the step-drawdown and constant rate pumping tests.

B. The Contractor shall submit to the Consultant for review the following step-drawdown test data: pre-pumping (static) water level and time measured, pumping water levels for each pumping rate step and time measured, flow meter and totalizer readings for each pumping rate step and times measured, and sand content for each pumping rate step and times measured.

C. Prior to commencement of the step-drawdown and constant rate pumping tests the Contractor shall provide a written certification that the flow meter and totalizer are calibrated to the manufacturer's specifications (+/-2%).

D. The Contractor shall submit to the Consultant for review the following constant rate pumping test data: pre-pumping (static) water level and time measured, pumping water levels and times measured, flow meter and totalizer readings and times measured, and sand content and times measured. The Contractor shall also submit to the Consultant for review the recovery water levels and times measured for either 24 hours or until 90% recover has been reached, whichever is shorter.

11.11 Measurements and Payments

Full compensation for complying with the requirements of Section 11.0 pertaining to step-drawdown and constant rate pumping tests shall be made at the unit price for "Conduct 15-Hour Step-Drawdown Test and 120-Hour Constant Rate Pumping Test", described in Bid Schedule, and no additional compensation will be allowed.

***** End of Section *****

12.0 Plumbness and Alignment Test and Gyroscopic Survey

12.1 General

After the step-drawdown and constant rate pumping tests have been completed, the Contractor shall conduct a plumbness and alignment test of the well.

12.2 Plumbness and Alignment Requirements

The well shall meet all the following plumbness and alignment requirements.

1 ANSI/AWWA A100-20.

2 Plumbness tolerance. The maximum allowable horizontal deviation (drift) from vertical shall not exceed 13.40 inches per 100 feet of depth from the top of the well to the bottom of the well casing in accordance with ANSI/AWWA A100-20.

3 Alignment tolerance. The maximum allowable misalignment or "dogleg" is one that will allow a 40-foot-long dummy cylinder to pass freely and unobstructed from the top of the well to a depth within 20% of the bottom of the well. If the well fails to meet the above requirements, the Contractor must correct the plumbness and alignment to the satisfaction and approval of the Consultant and the Owner. Plumbness and alignment correction costs will be borne by the Contractor at no cost to the Owner.

12.3 Gyroscopic Survey

To demonstrate compliance with the plumbness and alignment requirements, the Contractor shall conduct a gyroscopic survey of the production well under the observation of the Consultant and/or Owner. The quality and clarity of the gyroscopic log must be approved by the Consultant.

The gyroscopic survey logging Subcontractor and the specific gyroscopic logging tool to be used must be approved by the Consultant. The gyroscopic survey tool shall be centralized in the well, and the geophysical logging Subcontractor shall conduct two (2) 50-foot repeat sections to demonstrate accuracy and repeatability of the gyroscopic survey. The Consultant shall determine the location of the repeat sections based on the preliminary results of the gyroscopic survey. It is anticipated that one of the repeat sections may be the location of the proposed pump setting.

12.4 Dummy Cylinder

To demonstrate compliance with the plumbness and alignment requirements, the Contractor may be required to furnish, install, and remove a test cylinder. The test cylinder shall be 40-feet long and no smaller than 2" less than the casing diameter (OD).

12.5 Submittals

A. The Contractor shall submit for review and approval by the Consultant the name and contact information for the gyroscopic logging Subcontractor and the specific gyroscopic logging tool (specification or cut sheets) to be used.

B. The gyroscopic survey Subcontractor shall provide two (2) field copies of the gyroscopic surveys to the Consultant and the Owner at the well site, immediately following the completion of gyroscopic survey.

C. The gyroscopic survey Subcontractor shall within ten (10) working days following completion of the gyroscopic survey submit to the Consultant and the Owner two (2) final copies of the gyroscopic survey and one (1) electronic copy of the logging data in a PDF format approved by the Consultant.

D. The gyroscopic survey Subcontractor shall also provide a written plumbness and alignment report that shall include 1) the numerical values of the well deviation and 2) a graphical diagram of the well alignment from both a profile perspective (both Northing and Easting views) and a vertical perspective.

12.6 Measurements and Payments

Full compensation for complying with the requirements pertaining to the plumbness and alignment test and gyroscopic survey shall be made at the lump sum price for “Plumbness and Alignment Test and Gyroscopic Survey”, described in Bid Schedule, and no additional compensation will be allowed.

***** End of Section *****

13.0 As-Built Video Log

13.1 General

After the completion of the plumbness and alignment testing, the Contractor shall conduct a downhole color video log of the well. Any materials added to the well to improve the water clarity prior to conducting the downhole video log shall be approved by the Consultant prior to use.

13.2 Downhole Video Log

The downhole video camera shall be capable of producing a clear and focused image of the well utilizing a downhole view lens and a side scanning lens. The video survey shall, at a minimum, consist of a continuous down-hole scan, with periodic side-view scans at intervals requested by the Consultant to document well depth, perforation depths, well casing condition, and presence of obstructions and/or debris in the bottom of the well. Prior to commencement of the video log the Contractor shall submit to the Consultant for review and approval the name and qualifications of the geophysical logging subcontractor.

The video survey shall be conducted under the observation of the Consultant and the quality and clarity of the well video must be acceptable to the Consultant.

Prior to introduction into the well the camera equipment shall be thoroughly washed and disinfected in a manner acceptable to the Consultant.

13.3 Submittals

A. The geophysical logging subcontractor shall submit to the Consultant and Owner two (2) copies of the well video in a DVD or flash drive format.

B. The geophysical logging subcontractor shall submit to the Consultant two (2) copies of the well video log report that includes, at a minimum, the following: depth intervals of blank casing, mill slotted casing, welds, and water level. The geophysical logging subcontractor shall also provide one (1) electronic copy of the well video log report in a .pdf format.

13.4 Measurements and Payments

Full compensation for complying with the requirements of Section 13.0 pertaining to as-built video log shall be made at the lump sum price for “As-Built Video Log”, described in Bid Schedule, and no additional compensation will be allowed.

***** End of Section *****

14.0 Disinfect Well and Furnish and Install Temporary Cap

14.1 General

After completion the downhole video log and static spinner survey, the Contractor shall disinfect the well and install a temporary cap on the well.

14.2 Disinfection

1. The well shall be disinfected in accordance with ANSI/AWWA A100-20 Section 4.9 and AAC Rule R12-15-814 to a minimum 50 mg/l residual in the water column.

2. Sodium hypochlorite solution shall be used to disinfect the well at a final concentration of no less than 10%. The volume of water in the well includes the well volume and the portions of the borehole filled with gravel pack. This volume of water and the concentration of the disinfectant materials (e.g., 10% Sodium Hypochlorite) shall dictate the volume of disinfectant to be placed in the well.

14.3 Temporary Capping

1. Upon completion of all work, the well shall be capped by installing a tack-welded steel cover on the top of the well casing.

14.4 Submittals

A. The specific method including equipment and disinfectant to be used to disinfect the well along with dosage calculations to meet the requirements of this section must be approved by the Consultant prior to commencement of disinfection operations.

14.5 Measurements and Payments

Full compensation for complying with the requirements pertaining to disinfect well and furnish and install temporary cap shall be made at the lump sum price for “Disinfect Well, Furnish and Install Temporary Cap”, described in Bid Schedule, and no additional compensation will be allowed.

***** End of Section *****

15.0 Acceptance of Work

The Owner and Consultant shall agree that the Contractor has completed the work in accordance with the specifications and that the well meets the following requirements.

1. The conductor casing shall meet the plumbness and alignment requirements.

2. The well casing and perforated casing shall meet the plumbness and alignment requirements.

3. The well shall meet the sand content requirements.

4. All installed materials shall be new and free from defects.

5.The well site has been returned to a near pre-existing condition.

***** End of Section *****