


**TECHNICAL SPECIFICATIONS FOR
INSTALLATION AND TESTING OF FIFTEEN TEST WELLS
AND TWO OBSERVATION WELLS,
LEE COUNTY UTILITIES PERMIT 36-00003-W,
SOUTHEAST LEE COUNTY AREA, FL**

Prepared for:

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SECTION 1 – SCOPE OF WORK

The Scope of Work for this project includes furnishing all labor and materials for the installation and testing of five (5) Upper Floridan aquifer (UFA) test wells, five (5) Sandstone aquifer (SSA) test wells, five (5) Surficial aquifer system (SAS) test wells, one (1) SSA observation well, and one (1) SAS observation well. The proposed wells are located in southeastern Lee County, Florida (Figure 1). The purpose of the drilling and testing of the wells is to provide hydrogeologic data to be used in the possible expansion of the Corkscrew and Green Meadows water supply groundwater wellfields. The OWNER may complete the project in two phases. Phase I will include two well clusters composed of 6 test wells and two observation wells for the Green Meadows wellfield. Phase II will include three well clusters composed of nine test wells for the Corkscrew wellfield. The two phases may or may not be completed continuously.

The scope includes, but is not limited to:

- Obtaining the necessary permits to construct the wells, including Lee County test well construction permits, Florida Department of Environmental Protection (FDEP) Generic National Pollutant Discharge Elimination System (NPDES) permits, and as needed, Lee County clearing permits and right-of-way permits.
- Clearing, grubbing, and site preparation for the wells.
- Construction, development, and testing of five 8-inch diameter by approximately 1,000 feet test wells, plugged back after testing to approximately 800 feet BLS, with casing set at approximately 550 feet BLS (Figure 2).
- Construction, development, and testing of five 8-inch diameter SSA test wells to approximately 250 feet BLS with casing set at 150 feet BLS (Figure 3).
- Construction, development, and testing of five 8-inch diameter SAS test wells to approximately 150 feet BLS with casing set at 50 feet BLS (Figure 4).
- Construction and development of one 4-inch diameter SSA observation well, with total depth of approximately 250 feet BLS and casing depth of approximately 150 feet BLS (Figure 5).
- Construction and development of one 4-inch diameter SAS observation well, with total depth of approximately 150 feet BLS and casing depth of approximately 50 feet BLS (Figure 6).
- Geophysical logging of the fifteen test wells and two observation wells and video logging of the fifteen test wells.
- Conducting packer testing in the five UFA test wells.
- Installing a test pump and conducting a specific capacity pumping test in each of the test wells.

- Conducting two 48-hour aquifer performance tests at pumping rates requested by the ENGINEER in two test wells while recording water levels in the nearby observation wells.
- Providing an as-built drawing and survey plat with horizontal and vertical control information for each test well site.
- Installing a flange on the wellhead of each well to be retained at an elevation, as shown on Figure 7, along with a locking steel protective casing, well pad, and bumper posts.
- Plugging and abandoning any of the test or observation wells not to be retained.
- Site restoration of the five well site clusters.

SECTION 2 – CONTRACTOR RESPONSIBILITIES

The work herein described consists of the drilling and testing of five (5) UFA test wells, five (5) SSA test wells, five (5) SAS test wells, one (1) SSA observation well, and one (1) SAS observation well for Lee County Utilities to obtain hydrogeologic data for water use permit 36-00003-W supplying the Corkscrew and Green Meadows water treatment plants (WTPs).

The purpose of these technical specifications is to provide for the furnishing of all labor, equipment, material and performing all operations for the installation, geophysical logging, packer testing, and aquifer testing of the wells.

The CONTRACTOR shall be responsible for all labor, materials, taxes, transportation, tools, supplies, equipment, and appurtenances necessary to construct, develop, and test the wells as specified herein. In general, all methods and material used under this section shall be in accordance with the latest revisions of the American Water Works Association Standard for Deep Wells (AWWA A100-15) and the National Ground Water Association Standards as they apply to the particular needs or conditions encountered in the proposed work.

SECTION 3 – PERMITS

The CONTRACTOR shall procure all permits, certificates, and licenses required by law for the execution of the work. The CONTRACTOR shall comply with all Federal, State, and local regulations and ordinances relating to the performance of the work. The ENGINEER will provide the CONTRACTOR with pertinent information related to the permitting. However, it shall be the CONTRACTOR'S responsibility to file the permit applications, supply the permit application fees, and comply with the conditions of the relevant permits. The following permits, at a minimum, will be needed for the project: (1) Lee County well construction permits, (2) FDEP generic NPDES permits, (3) as needed, Lee County clearing permits, and (4) as applicable, Lee County right-of-way use permits. The CONTRACTOR will need to provide a maintenance of traffic (MOT) plan for each well site, as applicable. The ENGINEER must be furnished a copy of each permit prior to commencing work for a specific well site.

SECTION 4 – EQUIPMENT AND PERSONNEL

The CONTRACTOR shall furnish capable personnel and equipment to construct the wells by rotary drilling with mud and reverse-air circulation as outlined in Section 8.

Portable mud systems shall be used by the CONTRACTOR during drilling of the boreholes to final casing setting depth. No in-ground pits will be allowed. During reverse air drilling of the open-hole portions of the wells below casing setting depth, all discharged water must be routed to a stormwater discharge location previously identified at each wellsite in the generic NPDES permit. The end of pipe discharge points shall be equipped with sediment screens or hay baffles to filter the discharged water during drilling, well development, and pumping tests.

The equipment utilized by the CONTRACTOR shall be suitable for use in construction of deep, high flowing artesian, large-diameter municipal water supply wells. Equipment commonly used for small-diameter domestic supply wells, such as small capacity paddle cement mixers, will not be approved by the ENGINEER.

The CONTRACTOR shall furnish a list of equipment and personnel with its bid.

SECTION 5 – MATERIALS

Well construction materials shall be in accordance with the following requirements:

- 5.1 Drilling Fluid: No drilling fluid other than clear potable water will be used in the open hole section of the well below the final casing. Fluids used during drilling of the pilot hole and the reaming of the cased portion of hole shall be approved for use in construction of municipal public supply wells. If drilling mud is used as the drilling fluid for the portion of the hole prior to setting casing, portable mud pits must be used. Construction of in-ground mud pits at the site will not be allowed. The CONTRACTOR shall dispose of all drilling fluids in accordance with applicable regulations at a site approved by the Florida Department of Environmental Protection (FDEP) and shall provide the ENGINEER with a copy of the FDEP approval.
- 5.2 Well Casing: All casings shall be new, approved for use in municipal public supply wells and to specifications as outlined under "Well Construction Sequence" in this section. Centralizers shall be installed on the casings at the intervals specified herein (see Section 8.9). Payment for permanent well casing shall be at the unit price of the contract as measured from land surface to depth of casing. The contract will indicate an estimate of the amount of casing for the well; however, actual field conditions will dictate the exact amount of casing. This will be determined by the ENGINEER.
- 5.3 Annular Grout: The deep permanent well casing grout shall be API Class B (ASTM Type II) Portland cement mixed with no more than 5.2 gallons of water per sack of cement. Surface casing grout may be API Class A (ASTM Type I) cement mixed with no more than 5.2 gallons of water per sack. Only fresh water may be used for grout mix. A cementing plan for each stage of cement shall be submitted to the ENGINEER for approval prior to emplacement of any cement grout. The first stage of each cementing operation shall be performed using the pressure grout method. For all subsequent stages, performed using the tremie method, the bottom of the tremie pipe shall be set no more than five feet above the bottom of the interval to be grouted. The first cement stage and the basal 200 feet emplaced around the final casing shall be neat. Subsequent stages shall contain no more than 5% bentonite.
- 5.4 Plug Back Grout: The plug back grout shall be API Class B (ASTM Type II) Portland cement mixed with no more than 5.2 gallons of water per sack of cement. Only fresh water may be used for grout mix. A cementing plan for each stage of cement shall be submitted to the ENGINEER for approval prior to emplacement of any cement grout. All cement for the plug back shall be neat.

SECTION 6 – SUBMITTALS/SHOP DRAWINGS

- 6.1 Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:
- (1) All field measurements, quantities, dimensions, specified performance, and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - (2) The suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;
 - (3) All information relative to the CONTRACTOR'S responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;
 - (4) That each Shop Drawing or Sample has been cross-checked with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.
- 6.2 Each submittal shall bear a stamp or specific written certification signed by a designated company officer that the CONTRACTOR has satisfied CONTRACTOR'S obligations under the Contract Documents.
- 6.3 All Submittals shall be conveyed to the ENGINEER for review and approval, allowing for sufficient time for such review. One electronic and three (3) paper copies of each submittal shall be provided to the ENGINEER. No submittal shall be deemed to have been approved by the ENGINEER without the CONTRACTOR having received approval in writing.

SECTION 7 – SITE PREPARATION

Requirements include clearing of all access and work areas within the OWNER's project site(s) and right(s)-of-way as necessary to complete the Work, including work designated in permits and other agreements. Note that each of the well sites is anticipated to be in an upland area.

Related work includes introduction of fill material as necessary, grading, backfilling, restoration of growth, and site cleanup.

The CONTRACTOR shall exercise extreme care to avoid unnecessary disturbance of property.

SECTION 8 – WELL CONSTRUCTION

8.1 Construction Sequence for UFA Test Wells

- 8.1.1 Drill a nominal 8-inch diameter pilot hole by mud rotary method to approximately 50 feet BLS. Ream pilot hole to 18-inch diameter. Install approximately 50 feet of 14-inch diameter PVC surface casing to the satisfaction of the ENGINEER.
- 8.1.2 Drill a nominal 14-inch diameter borehole to a depth of approximately 550 feet using the mud rotary method. All wellbores drilled as part of this contract shall meet the plumbness and alignment conditions set forth in Section 8.9.
- 8.1.3 Prepare the holes for geophysical logging by circulation of the drilling fluid until it is uniform and free of drill cuttings. Perform geophysical logging (Borehole Compensated Sonic, Dual Induction, Gamma Ray/Caliper, Spontaneous Potential).
- 8.1.4 Set an 8-inch outside diameter SDR 17 Certa-Lok PVC casing with centralizers as specified. Grout the annular space to land surface in stages, with the first stage being neat cement by the pressure grout method. The basal 200 feet of grout shall be neat. Subsequent cementing stages shall be by the tremie method and may contain up to 5% bentonite. Perform temperature logs after each grout stage.
- 8.1.5 Drill a nominal 8-inch diameter hole by reverse air method to approximately 1,000 feet BLS. CONTRACTOR is responsible for measuring and recording pumping rate and water level during specific capacity tests at each rod connection. Static water levels shall be collected after approximately 20 minutes or at the beginning of the day.
- 8.1.6 Conduct geophysical logging at total depth, to include Gamma Ray/Caliper, Dual Induction, Sonic, Spontaneous Potential, Flow (dynamic and static), Conductivity/Temperature (dynamic and static), and video logs.
- 8.1.7 Conduct one packer test of the bottom-hole interval selected by the ENGINEER using a single packer to isolate the test interval.
- 8.1.8 Plug back the test wells to a depth of approximately 800 feet BLS, as specified by the ENGINEER using neat Portland cement.
- 8.1.9 Develop the wells for up to 8 hours.
- 8.1.10 Install a submersible test pump, at an approximate depth of 120 feet BLS in the test wells, capable of pumping up to 700 gpm, equipped with a throttling valve. Conduct a five-step specific capacity pumping test for one hour per pumping rate.
- 8.1.11 Install a wellhead flange and other surface equipment. The flange elevation (see Figure 7) will be provided by the ENGINEER and is to be set at a minimum of 1.0

foot above the 100-year flood elevation. The additional surface equipment shall consist of a 316 stainless steel (SS) wellhead flange equipped with three access ports, each fitted with 316 SS valves, a locking steel protective casing, a concrete well pad, and four concrete-filled four-inch diameter PVC bumper posts, one located at each corner of the well pad (Figure 7). Provide an as-built drawing and survey plat with horizontal and vertical control information. Surveying to be conducted by a licensed Land Surveyor.

- 8.1.12 Demobilize and restore each site. The wells shall be left clean; free of oils, grease, or other substances used during well construction and testing.

8.2 Construction Sequence for SSA Test Wells

- 8.2.1 Drill a nominal 8-inch diameter pilot hole by mud rotary method to approximately 50 feet BLS. Ream pilot hole to 18-inch diameter. Install approximately 50 feet of 14-inch diameter PVC surface casing to the satisfaction of the ENGINEER.
- 8.2.2 Drill a nominal 14-inch diameter borehole to a depth of approximately 150 feet using the mud rotary method. All wellbores drilled as part of this contract shall meet the plumbness and alignment conditions set forth in Section 8.9.
- 8.2.3 Prepare the holes for geophysical logging by circulation of the drilling fluid until it is uniform and free of drill cuttings. Perform geophysical logging (Gamma Ray/Caliper).
- 8.2.4 Set an 8-inch outside diameter SDR 17 Certa-Lok PVC casing with centralizers as specified. Grout the annular space to land surface in stages, with the first stage being neat cement by the pressure grout method. The grout shall be neat. If the cement is not brought inside the surface casing, perform a temperature log.
- 8.2.5 Drill a nominal 8-inch diameter hole by mud rotary to approximately 250 feet BLS.
- 8.2.6 Develop the wells for up to 8 hours.
- 8.2.7 Conduct geophysical logging at total depth, to include Gamma Ray/Caliper, Dual Induction, Sonic, Spontaneous Potential, Flow (dynamic and static), Conductivity/Temperature (dynamic and static), and video logs.
- 8.2.8 Install a submersible test pump, at an approximate depth of 120 feet BLS in the test wells, capable of pumping up to 700 gpm, equipped with a throttling valve. Conduct a five-step specific capacity pumping test for one hour per pumping rate.
- 8.2.9 Install a wellhead flange and other surface equipment. The flange elevation (see Figure 7) will be provided by the ENGINEER and is to be set at a minimum of 1.0 foot above the 100-year flood elevation. The additional surface equipment shall

consist of a 316 stainless steel (SS) wellhead flange equipped with three access ports, each fitted with 316 SS valves, a locking steel protective casing, a concrete well pad, and four concrete-filled four-inch diameter PVC bumper posts, one located at each corner of the well pad (Figure 7). Provide an as-built drawing and survey plat with horizontal and vertical control information. Surveying to be conducted by a licensed Land Surveyor.

8.2.10 Demobilize and restore each site. The wells shall be left clean; free of oils, grease, or other substances used during well construction and testing.

8.3 Construction Sequence for SAS Test Wells

8.3.1 Drill a nominal 14-inch diameter borehole to a depth of approximately 50 feet using the mud rotary method. All wellbores drilled as part of this contract shall meet the plumbness and alignment conditions set forth in Section 8.9.

8.3.2 Prepare the holes for geophysical logging by circulation of the drilling fluid until it is uniform and free of drill cuttings. Perform geophysical logging (Gamma Ray/Caliper).

8.3.3 Set an 8-inch outside diameter SDR 17 Certa-Lok PVC casing with centralizers as specified. Grout the annular space to land surface in stages, with the first stage being neat cement by the pressure grout method. The grout shall be neat.

8.3.4 Drill a nominal 8-inch diameter hole by mud rotary to approximately 150 feet BLS.

8.3.5 Develop the wells for up to 8 hours.

8.3.6 Conduct geophysical logging at total depth, to include Gamma Ray/Caliper, Dual Induction, Sonic, Spontaneous Potential, Flow (dynamic and static), Conductivity/Temperature (dynamic and static), and video logs.

8.3.7 Install a submersible test pump, at an approximate depth of 50 feet BLS in the test wells, capable of pumping up to 700 gpm, equipped with a throttling valve. Conduct a five-step specific capacity pumping test for one hour per pumping rate.

8.3.8 Install a wellhead flange and other surface equipment. The flange elevation (see Figure 7) will be provided by the ENGINEER and is to be set at a minimum of 1.0 foot above the 100-year flood elevation. The additional surface equipment shall consist of a 316 stainless steel (SS) wellhead flange equipped with three access ports, each fitted with 316 SS valves, a locking steel protective casing, a concrete well pad, and four concrete-filled four-inch diameter PVC bumper posts, one located at each corner of the well pad (Figure 7). Provide an as-built drawing and survey plat with horizontal and vertical control information. Surveying to be conducted by a licensed Land Surveyor.

- 8.3.9 Demobilize and restore each site. The wells shall be left clean; free of oils, grease, or other substances used during well construction and testing.

8.4 Construction Sequence for the SSA Observation Well.

- 8.4.1 Drill a nominal 8-inch diameter pilot hole by mud rotary method to approximately 50 feet BLS. Ream the pilot hole to 14-inch diameter. Install approximately 50 feet of 8-inch diameter PVC surface casing to the satisfaction of the ENGINEER.
- 8.4.2 Drill a nominal 8-inch diameter borehole to a depth of approximately 150 feet BLS using the mud rotary method. All wellbores drilled as part of this contract shall meet the plumbness and alignment conditions set forth in Section 8.9.
- 8.4.3 Prepare the hole for geophysical logging by circulation of the drilling fluid until it is uniform and free of drill cuttings. Perform geophysical logging (Gamma Ray/Caliper).
- 8.4.4 Set 4-inch outside diameter PVC casing with centering guides as specified. Grout the annular space to land surface in stages, with the first stage being neat cement by the pressure grout method. Subsequent cementing stages shall be by the tremie method and may contain up to 5% bentonite.
- 8.4.5 Drill a nominal 4-inch diameter borehole by mud rotary method to a depth of approximately 250 feet BLS.
- 8.4.6 Conduct geophysical logging at total depth to include Gamma Ray/Caliper.
- 8.4.7 Develop the well up to 8 hours.
- 8.4.8 Install a wellhead flange and other surface equipment for the observation well to be retained. The flange elevation (see Figure 5) will be provided by the ENGINEER and is to be set 1.0 foot above the 100-year flood elevation. The additional surface equipment shall consist of a 316 SS wellhead flange equipped with two access ports equipped with a 316 SS ball valve, locking steel protective casing, a concrete well pad, and four concrete-filled four-inch diameter PVC bumper posts, one located at each corner of the well pad (Figure 9). Provide as-built drawing and survey plat with horizontal and vertical control information for each site. Surveying to be conducted by licensed Land Surveyor.
- 8.4.9 Demobilize and clean each site.

8.5 Construction Sequence for the SAS Observation Well.

- 8.5.1 Drill a nominal 10-inch diameter borehole to a depth of approximately 50 feet BLS using the mud rotary method. All wellbores drilled as part of this contract shall meet the plumbness and alignment conditions set forth in Section 8.9.

- 8.5.2 Prepare the hole for geophysical logging by circulation of the drilling fluid until it is uniform and free of drill cuttings. Perform geophysical logging (Gamma Ray/Caliper).
- 8.5.3 Set 4-inch outside diameter PVC casing with centering guides as specified. Grout the annular space to land surface in stages, with the first stage being neat cement by the pressure grout method. Subsequent cementing stages shall be by the tremie method and may contain up to 5% bentonite.
- 8.5.4 Drill a nominal 4-inch diameter borehole by mud rotary method to a depth of approximately 150 feet BLS.
- 8.5.5 Conduct geophysical logging at total depth to include Gamma Ray/Caliper.
- 8.5.6 Develop the well up to 8 hours.
- 8.5.7 Install a wellhead flange and other surface equipment for the observation well to be retained. The flange elevation (see Figure 5) will be provided by the ENGINEER and is to be set 1.0 foot above the 100-year flood elevation. The additional surface equipment shall consist of a 316 SS wellhead flange equipped with two access ports equipped with a 316 SS ball valve, locking steel protective casing, a concrete well pad, and four concrete-filled four-inch diameter PVC bumper posts, one located at each corner of the well pad (Figure 9). Provide as-built drawing and survey plat with horizontal and vertical control information for each site. Surveying to be conducted by licensed Land Surveyor.
- 8.5.8 Demobilize and clean each site.

8.6 Plug and Abandonment Procedures (If Necessary)

- 8.6.1 Obtain well abandonment permits from Lee County Natural Resources.
- 8.6.2 Kill well, as necessary.
- 8.6.3 Install cementing tubing to a depth of no more than feet above total well depth.
- 8.6.4 Pump neat cement to land surface.

8.7 Formation and Water Samples for UFA Test Wells

A representative of the ENGINEER will collect formation and water samples during drilling of the UFA test wells. Formation samples will be collected continuously and bagged every ten feet. Clear water samples will be collected every 10 feet during reverse air drilling from the discharge point. The contractor shall provide an appropriate sampling port in the discharge line for collection of reverse air water samples. Specific capacity pumping tests during reverse air

drilling will include static water levels, discharge rates, and pumping water levels at drill rod connections.

8.8 Packer Testing

The CONTRACTOR shall provide and install equipment necessary for packer testing. Packer assembly shall be capable of being used as a dual-seat, or open-hole single packer of a diameter and length capable of sealing the borehole. The packer element shall be capable of being attached to drill pipe of minimum diameter of four inches. The CONTRACTOR shall provide all appurtenances needed to run the packer tests. Equipment shall include a submersible pump and pump column capable of being set at a depth of 150 feet BLS inside the drill pipe. The pump shall be capable of pumping at a rate of up to 150 gpm. The pump discharge assembly shall be equipped with a throttling valve, a totalizer flowmeter, and access to allow for insertion of a water level measuring device inside the drill pipe. For each packer test, the CONTRACTOR shall perform a preliminary test to assure a formation seal has been attained and the pumping setup is working as intended. Each pretest shall be for a minimum of one hour. If deemed necessary by the ENGINEER, the CONTRACTOR shall reset the packer element(s) to prevent leakage and/or malfunction. The CONTRACTOR shall facilitate and assist the ENGINEER in data collection and water sampling during the packer tests.

8.9 Well Plumbness and Alignment

The completed well shall be sufficiently plumb and straight so that there will be no interference with installation, alignment, operation, or removal of the test pump. The maximum allowable inclination from the vertical at any portion of a hole or survey point shall be one (1) degree; the maximum allowable difference between any two successive survey points shall be 0.5 degree. Any deviation greater than one (1) degree or difference greater than 0.5 degree between two surveys shall be corrected by the CONTRACTOR at his own expense.

Should the ENGINEER request, the alignment shall be tested by lowering into the well to a depth of at least 235 feet, a section of pipe 20 feet long or a dummy of the specified pump length. The outer diameter of the test pipe or dummy shall not be more than 1-inch smaller than the inside diameter of that part of the casing or hole being tested. The lowered unit shall pass freely through the entire tested depth. Alternatively, well plumbness shall be determined using a TOTCO type wireline inclination survey tool during the drilling operations, or other method approved by the ENGINEER. Wireline deviation surveys should be recorded at 90 foot intervals during the pilot hole drilling and reaming operations. Use of wireline methods during drilling does not relieve the CONTRACTOR of the responsibility of installing a plumb completed well.

Centralizers shall be installed on the casing during casing setting operations at the following depths: (a) one set 20 feet from the base of casing, (b) three sets at 40 foot intervals above the bottom centralizers and at 200 foot intervals thereafter (i.e. at 60 feet, 100 feet, 140 feet, 340 feet, 540 feet, etc. above the casing seat), and (c) one set 20 feet from the land surface.

If the well fails the well plumbness and alignment test, the well shall be repaired as directed by the ENGINEER. If, in the opinion of the ENGINEER, the well cannot be repaired, the well shall be plugged as per current state and/or local requirements and a new well constructed, all at the CONTRACTOR'S expense. The CONTRACTOR shall perform well plumbness and alignment tests at no cost to the OWNER.

8.10 Geophysical Logging

When the borehole has been drilled to a depth determined by the ENGINEER, it must be prepared for geophysical logging. The geophysical logging company to be used for each logging event shall be approved in advance by the ENGINEER. Borehole preparation shall include, but not be limited to: 1) continuation of circulation until drill cuttings have been removed from the borehole; and 2) during rotary mud drilling, circulation of the drilling mud in the borehole until it is uniform. The CONTRACTOR must make all reasonable efforts to leave the borehole free from obstructions in preparation for geophysical logging. The log(s) must be made immediately following the completion of borehole preparation unless otherwise stated in the contract or as stipulated by the ENGINEER.

The following sequence of logging should be performed:

(1) Prior to setting casing in UFA test wells:

- Borehole Compensated Sonic
- Dual Induction
- Gamma Ray
- Caliper
- Spontaneous Potential

Prior to setting casing in SSA test wells, SAS test wells, and observation wells:

- Gamma Ray
- Caliper

(2) At casing setting depth, subsequent to setting casing:

- Temperature

(4) At total depth in test wells:

- Dual Induction
- Gamma Ray
- Caliper
- Spontaneous Potential
- Flowmeter (Static and Dynamic)
- Fluid Conductivity/Temperature (Static and Dynamic)
- Borehole Compensated Sonic
- Video

At total depth in observation wells:

Gamma Ray Caliper

Field copies and final copies of all geophysical logs shall be provided in both paper and electronic (pdf and LAS) formats acceptable to the ENGINEER. The number of paper copies of each log shall be 4, unless otherwise directed by the ENGINEER.

8.11 Well Top Terminations

At all times during the progress of the work and at completion, the CONTRACTOR shall use reasonable precautions to prevent either tampering with any of the wells or the entrance of foreign material into any of the wells. At the end of each work day, each well shall be sealed to prevent it from free flowing. Upon completion of the work, the test and observation wells shall be completed as shown on Figure 7. The final flange elevation shall be at a height of 1.0 foot above the hundred-year flood elevation, final elevation to be provided by the ENGINEER.

8.12 Well Development

The CONTRACTOR shall air develop each well, using a sequential combination of reverse air in the open-hole then straight air in the casing, until, to the satisfaction of the ENGINEER, the discharge water is free of sediment. The CONTRACTOR shall place the drill stem in the open-hole section and vary this height during reverse air development to enhance development of the entire open-hole section. The CONTRACTOR shall frequently and regularly surge the well.

8.13 Video Logging

The CONTRACTOR shall perform a video of the entire interior of the cased and open-hole portions of the wells to the satisfaction of the ENGINEER. The CONTRACTOR shall provide two (2) high quality field copies of the video and 4 final copies of the video, all in DVD or other electronic format. The video logging contractor must be approved in advance by the ENGINEER.

8.14 Pumping Tests

The CONTRACTOR shall furnish, install and remove the necessary appurtenances and pumping equipment capable of pumping up to 700 gpm for the test wells with a throttling device so that the discharge may be reduced to 150 gpm. The CONTRACTOR shall furnish a gate valve and flowmeter (or orifice plate and manometer), to control and measure discharge. A removable threaded connection shall be present on the wellhead assembly to allow for use of a pressure transducer to accurately determine static water level, and access for an electrical water level meter when the well is pumped. The discharge rate may be varied at the ENGINEER'S direction. Discharged water shall be conducted from the pumped well to the nearest surface-

water body, storm sewer or ditch, as approved by the ENGINEER and as permitted by an applicable generic NPDES permit. A minimum distance of 300 feet to discharge point through approved piping or lined ditches to prevent movement of the discharged water into the surficial aquifer near the well is required. Storm drains shall be protected by sediment screens and hay bales.

The CONTRACTOR shall ensure easy access to the water surface to be measured. The CONTRACTOR shall leave the pump in the wells after the discharge is stopped for a minimum of 24 hours following the specific capacity pumping test. After the specific capacity of each test well, two 48-hour pumping tests at a constant pumping rate of approximately 700 gpm will be conducted. The 48-hour pumping tests will be conducted in a SSA test well and in a SAS test well. The CONTRACTOR shall provide an access port and install a pressure transducer to measure water levels in the pumped well and in the observation well during the aquifer performance test. The pressure transducers will be provided by the OWNER

Throughout the duration of each of the pumping tests, the CONTRACTOR shall provide personnel to maintain the operation of the pumping equipment, including fueling. If a pump ceases to operate during a pumping test, the pump shall either be repaired or replaced and the pumping test shall be repeated to the satisfaction of the ENGINEER.

8.15 Driller's Log

The driller shall keep and maintain a log indicating the general lithology, hardness, and bit penetration rate of the material through which each well has been drilled.

SECTION 9 – RESPONSIBILITY FOR MATERIALS

The CONTRACTOR shall be responsible for all material furnished by it and shall replace at its own expense all such material found defective in manufacture or damaged in handling.

The CONTRACTOR shall be responsible for the safe storage of material. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times.

SECTION 10 – HANDLING OF MATERIALS

All materials shall be delivered and distributed at the site by the CONTRACTOR. All casing, fittings, and accessories shall be loaded and unloaded so as to avoid shock or damage. Handling of casing and fittings shall conform to all manufacturers' recommendations. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

SECTION 11 - ENGINEER'S REPORT

The ENGINEER will prepare a daily report reflecting the pay items completed by the CONTRACTOR during the day. Each report will be signed by the ENGINEER and an authorized individual from the CONTRACTOR.

SECTION 12- MONTHLY CONSTRUCTION PROGRESS MEETINGS

The CONTRACTOR shall prepare for and provide a qualified representative to attend a monthly Construction Progress Meeting to be held at the construction site and attended by representatives of the ENGINEER and the OWNER. The Contractor shall provide an updated schedule and detail work completed during the previous month and work anticipated to be completed during the upcoming month. Monthly updates shall be provided to the ENGINEER with the pay application.

SECTION 13 - TIME OF COMPLETION

The CONTRACTOR shall complete all well construction work required in these specifications within 365 calendar days after the Notice to Proceed date. The OWNER reserves the right to divide the project in two phases. Phase I includes the test and observation wells for the Green Meadows wellfield and shall be completed within 150 calendar days after the Notice to Proceed date. Phase II includes the test wells for the Corkscrew wellfield and shall be completed within 215 calendar days after Phase I is completed and a second Notice to Proceed date is issued by the County.

SECTION 14 – PROTECTION OF PROPERTY

The CONTRACTOR shall take special precautions to reduce to a minimum the nuisances and damage to property which could result from working in residential areas and adjacent to roads. As applicable, and as directed by the ENGINEER, the CONTRACTOR shall file a traffic control plan and obtain approval within the appropriate local, county, or state traffic departments. Any damage to public or private property shall be immediately repaired and paid for by the CONTRACTOR at no expense to the OWNER. Equipment, tools, and materials shall be located in places where they will produce a minimum of nuisance. Appropriate warning signs, including lighted warnings, shall be posted on the streets and the Lee County Sheriff Department shall be informed of the location of the construction site.

A self-contained mud circulation system is required for all mud rotary drilling operations at the site. Construction of mud pits will not be allowed.

Upon completion of the work, the CONTRACTOR shall remove all drilling cuttings from the site and clean, re-grade, and restore the site.

SECTION 15 – CERTIFICATION OF CHEMICALS

All chemicals used during the project must show approval of either USEPA or the U.S. Department of Agriculture (USDA). The CONTRACTOR shall submit the most recent Material Safety Data Sheets (MSDS's) in accordance with OSHA Rule 29 Code of Federal Regulations (CFR) 1910.1200 for each chemical to be used during the project. Two copies shall be furnished to the ENGINEER.

SECTION 16 – SITE RESTORATION

The site shall be restored to its original contours and surface conditions. All drill cuttings shall be removed from the site by the CONTRACTOR to a site approved by appropriate regulatory agencies.

SECTION 17 – WELL ABANDONMENT

In the event that the CONTRACTOR shall fail to drill a well to the depth specified or to such lesser depth as requested by the ENGINEER, or fail to set or grout the casing to Lee County standards, or must abandon a well because of loss of tools or for any other cause, then CONTRACTOR shall, if requested by the ENGINEER, plug the well in accordance with standards and procedures specified in the Rules of Lee County and install a replacement well at no additional cost.

SECTION 18 – PAY ITEMS

1. FINAL MEASUREMENT

- A. The CONTRACTOR shall make all measurements and check all dimensions necessary for the proper execution of the work called for by the Specifications, and during the prosecution of the work he shall make all necessary measurements to prevent misfitting in said work and shall record such accurate measurements of the construction as provided for herein and as to be submitted to and approved by the ENGINEER.
- B. The method of measuring the work for payment under the various items shall be as indicated below. In any event, the unit or lump sum price for the respective items shall include the installation complete in all details and ready for use.

2. PAY ITEMS

- A. The unit prices stated in the Contract for the respective items shall be considered as the CONTRACTOR'S Schedule of Values for payment purposes. The unit prices shall be paid at the completion of work for each item. Payment will be made under each item only for work as it is not specifically included under other items. The OWNER shall retain 5% of payment for each item until the entire work is deemed complete and is accepted by the OWNER.
- B. INSTALLATION AND TESTING OF FIFTEEN TEST WELLS AND TWO OBSERVATION WELLS.

A bid sheet for each phase is provided. The CONTRACTOR shall furnish all material, labor, taxes, tools, and equipment required to complete the drilling and testing procedures, as follows:

ITEM NO. 1 – MOBILIZATION, SURVEYING, SITE WORK, AND PERMITTING

Mobilization, surveying, site work, and permitting will be paid for at the unit price per well cluster as listed in the Bid Proposal. The said unit price shall include the furnishing of all material, labor and equipment necessary to complete the work, including setting up of all equipment necessary to complete the work. Site work includes all clearing, access to the well site including any necessary culvert installation, temporary safety devices, and temporary fencing.

ITEM NO. 2 – INSTALL 14” DIAMETER PVC SURFACE CASING IN TEST WELLS

Installation of surface casing in each test well will be paid for at the lump sum price as listed in the Bid Proposal including time, equipment, tools, taxes, and materials necessary for the work.

ITEM NO. 3 – INSTALL 8” DIAMETER PVC SURFACE CASING IN OBSERVATION WELLS

Installation of surface casing in the observation well will be paid for at the lump sum price as listed in the Bid Proposal including time, equipment, tools, taxes, and materials necessary for the work.

ITEM NO. 4 – DRILL 14-INCH DIAMETER HOLE BY MUD ROTARY IN EACH TEST WELL

The actual length of hole drilled shall be measured vertically from the bottom of surface casing to bottom of the hole. Drilling of a 14-inch diameter hole by mud rotary for each test well will be paid at the unit price and shall include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work.

ITEM NO. 5 – DRILL 8-INCH DIAMETER HOLE BY MUD ROTARY IN THE OBSERVATION WELLS

The actual length of hole drilled shall be measured vertically from the bottom of surface casing to bottom of the hole. Drilling of an 8-inch diameter hole by mud rotary for the observation well will be paid at the unit price and shall include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work.

ITEM NO. 6 – CONDUCT GEOPHYSICAL LOGGING PRIOR TO SETTING CASING IN UFA TEST WELLS

Conduct geophysical logging prior to setting casing in each UFA test well will be paid for at the lump sum and shall include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work.

ITEM NO. 7 – CONDUCT CALIPER/GR PRIOR TO SETTING CASING IN SSA AND SAS TEST AND OBSERVATION WELLS

Conduct geophysical logging prior to setting casing in each SSA and SAS test and observation well will be paid for at the lump sum and shall include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work.

ITEM NO. 8 – INSTALL 8-INCH DIAMETER SDR 17 CERTA-LOK PVC CASING IN EACH TEST WELL

The actual length of 8-inch outside diameter SDR 17 PVC casing installed shall be measured from land surface to depth of the bottom of the casing. Installing an 8-inch diameter SDR 17 Certa-Lok PVC casing in each test well will be paid for at the specified unit price. The said price per foot shall include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work.

ITEM NO. 9 – INSTALL 4-INCH DIAMETER PVC CASING IN THE OBSERVATION WELLS

The actual length of 4-inch outside diameter PVC casing installed shall be measured from land surface to depth of the bottom of the casing. Installing a 4-inch diameter PVC casing in the observation wells will be paid for at the specified unit price. The said price per foot shall include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work.

ITEM NO. 10 – GROUT ANNULAR SPACE BETWEEN CASING AND BOREHOLE TO LAND SURFACE

Grout in place for the production casing and running temperature logs will be paid for at the unit price per 94 lb. bag of cement equivalent as listed in the Bid Proposal. The specified unit price shall include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work.

ITEM NO. 11 – DRILL NOMINAL 8-INCH DIAMETER BOREHOLE BY REVERSE AIR METHOD IN UFA TEST WELLS

The actual depth of hole drilled shall be measured vertically from bottom of the casing to the bottom of well. Drilling a nominal 8-inch diameter borehole by reverse air method in each test well shall be paid at the specified unit price and shall include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 12 – DRILL NOMINAL 8-INCH DIAMETER BOREHOLE BY MUD ROTARY METHOD IN THE SSA AND SAS TEST WELLS

The actual depth of hole drilled shall be measured vertically from bottom of the casing to the bottom of well. Drilling a nominal 8-inch diameter borehole by mud rotary method in the SSA and SAS test wells shall be paid at the specified unit price and shall include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 13 – DRILL NOMINAL 4-INCH DIAMETER BOREHOLE BY MUD ROTARY METHOD IN THE OBSERVATION WELLS

The actual depth of hole drilled shall be measured vertically from bottom of the casing to the bottom of well. Drilling a nominal 4-inch diameter borehole by mud rotary method in the observation wells shall be paid at the specified unit price and shall include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 14 – DEVELOP WELLS WITH AIR

Air development of the test and observation wells shall be paid at the specified unit price and include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 15 – CONDUCT OPEN-HOLE GEOPHYSICAL AND VIDEO LOGGING IN UFA TEST WELLS AT TOTAL DEPTH

Conducting geophysical and video logging in each UFA test wells at total depth shall be paid for on a lump sum basis and include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 16 – CONDUCT OPEN-HOLE GEOPHYSICAL AND VIDEO LOGGING IN SSA AND SAS TEST WELLS AT TOTAL DEPTH

Conducting geophysical and video logging in each SSA and WTA test wells at total depth shall be paid for on a lump sum basis and include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 17 – CONDUCT CALIPER/GR IN SSA AND SAS OBSERVATION WELLS AT TOTAL DEPTH

Conducting caliper/GR in each SSA and SAS observation wells at total depth shall be paid for on a lump sum basis and include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 18 – CONDUCT PACKER TESTING IN THE UFA TEST WELLS

Conducting packer testing in the UFA test wells shall be paid at the lump sum price and include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 19 – PLUG BACK THE UFA TEST WELLS

Plugging back the UFA test wells from approximately 1,000 feet BLS to approximately 800 feet BLS shall be paid for on the specified unit cost basis and shall include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 20 – CONDUCT SPECIFIC CAPACITY PUMPING TESTS

Conducting specific capacity pumping tests in each test well shall be paid for on a lump sum basis and include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 21 – CONDUCT 48-HOUR CONSTANT-RATE PUMPING TESTS

Conducting 48-hour constant-rate pumping tests in two test wells shall be paid for on a lump sum basis and include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 22 – EQUIP TEST OR OBSERVATION WELLS WITH SURFACE APPURTENANCES AND PROVIDE AS-BUILT SURVEY

If the OWNER decides to retain any of the test or observation wells for use as permanent observation wells, equipping each well with surface appurtenances and providing as-built drawings and survey plats shall be paid for on a lump sum basis and include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 23 – PLUG AND ABANDON TEST AND OBSERVATION WELLS

If the OWNER decides to abandon any of the test or observation wells, the abandonment work shall be paid for at the specified unit cost basis for cement grout and include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 24 – DEMOBILIZATION AND SITE RESTORATION

After completion of all work, each site shall be restore to its original contours and all work materials, equipment, traffic warning signs, and trash removed. Payment for this item shall be paid for on a lump sum basis and include the furnishing of all material, labor, tools, taxes, and equipment necessary to complete the work as specified.

ITEM NO. 25 – STANDBY WITH RIG AND DRILLING CREW ON-SITE

If standby time is required with the rig and drilling crew on site, payment will be made at the specified unit price based on the number of hours required.

ITEM NO. 26 – STANDBY WITH RIG ON-SITE AND DRILLING CREW OFF-SITE

If standby time is required with the rig on site and drilling crew off site, payment will be made at the specified unit price based on the number of hours required.

FIGURES

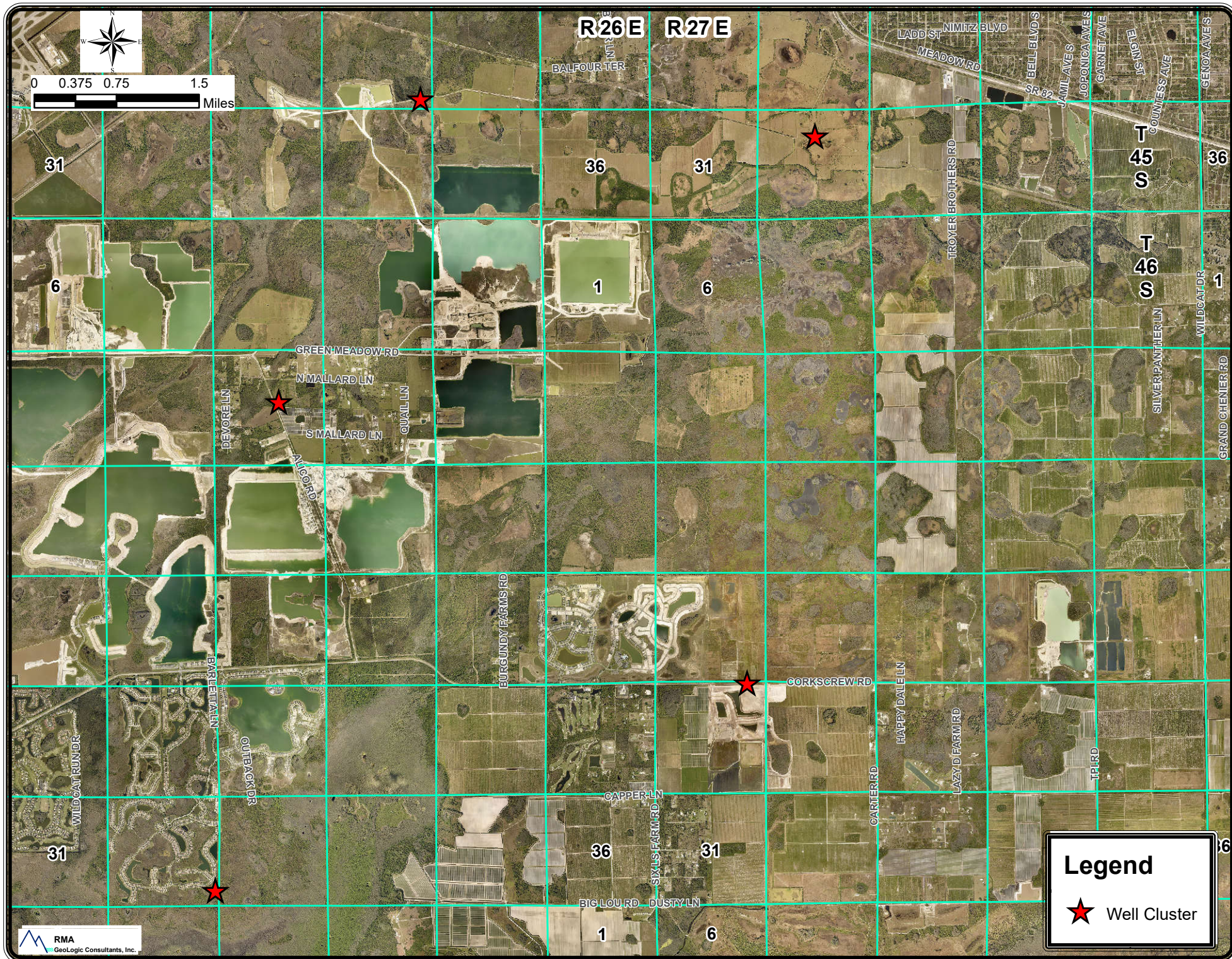


FIGURE 1- AERIAL PHOTO SHOWING PRELIMINARY LOCATION OF WELL CLUSTERS.

UPPER FLORIDAN AQUIFER TEST WELLS

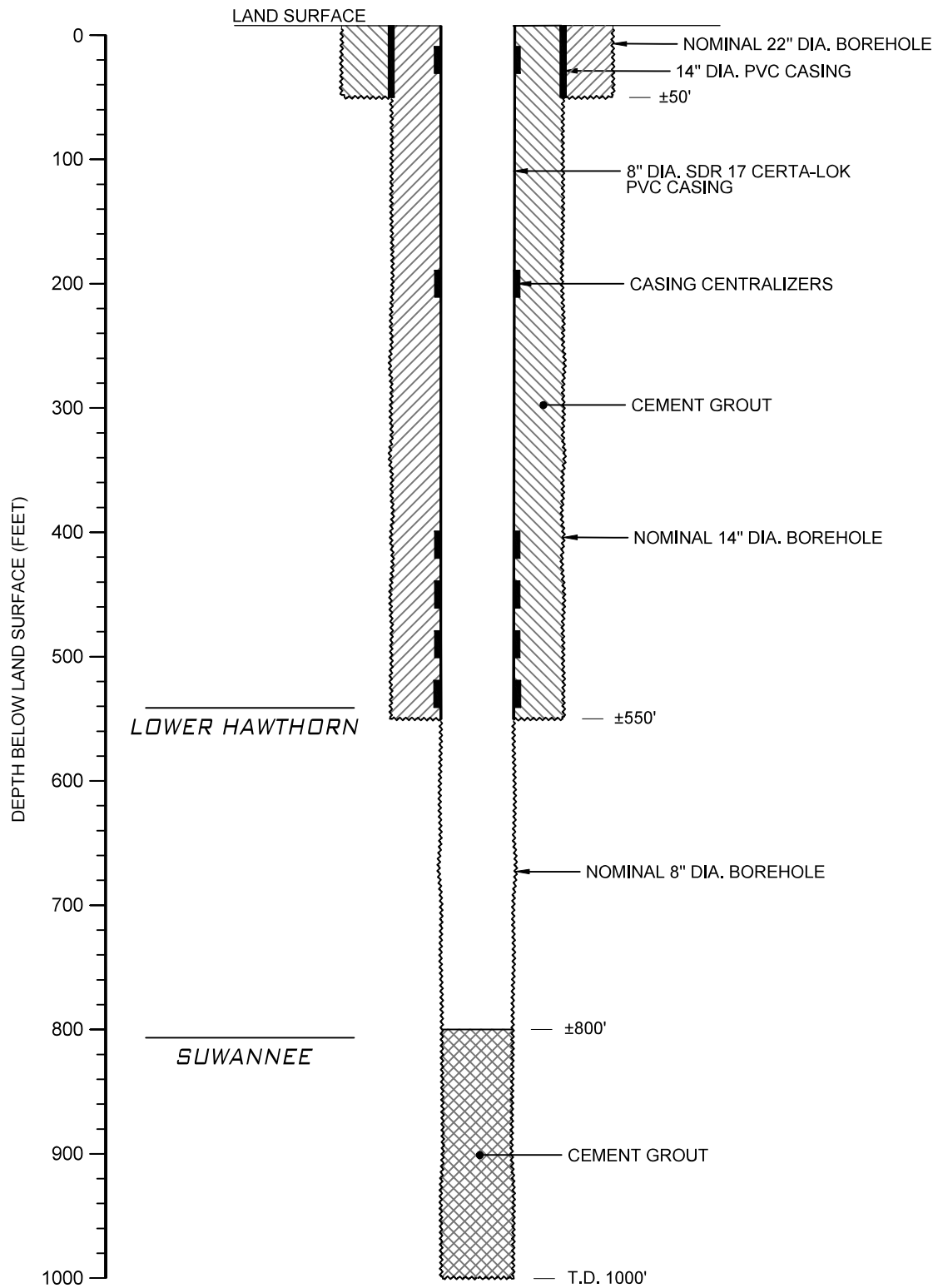


FIGURE 2- SCHEMATIC WELL CONSTRUCTION DIAGRAM FOR UPPER FLORIDAN AQUIFER TEST WELLS.

SANDSTONE AQUIFER TEST WELLS

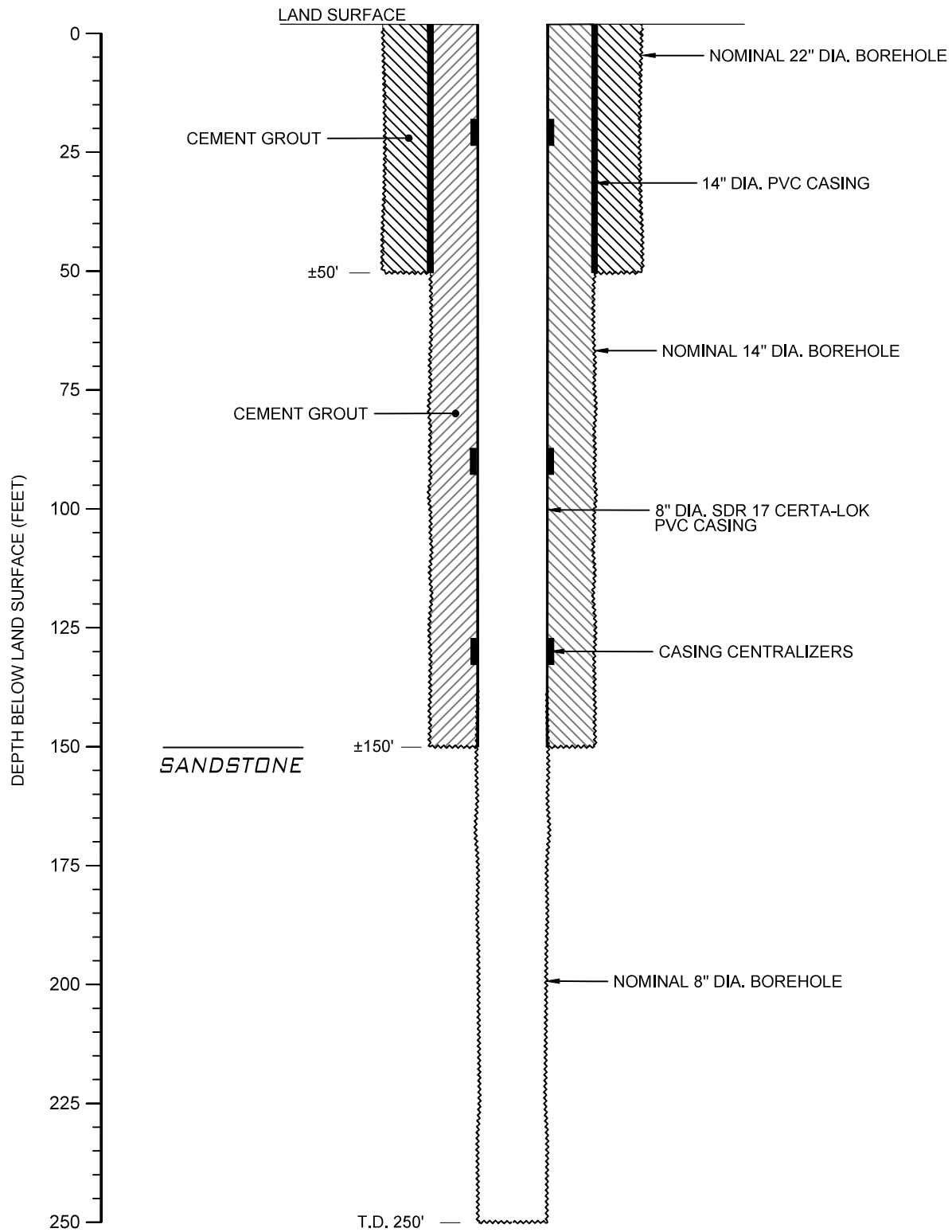


FIGURE 3- SCHEMATIC WELL CONSTRUCTION DIAGRAM FOR SANDSTONE AQUIFER TEST WELLS.

**SURFICIAL AQUIFER
TEST WELL**

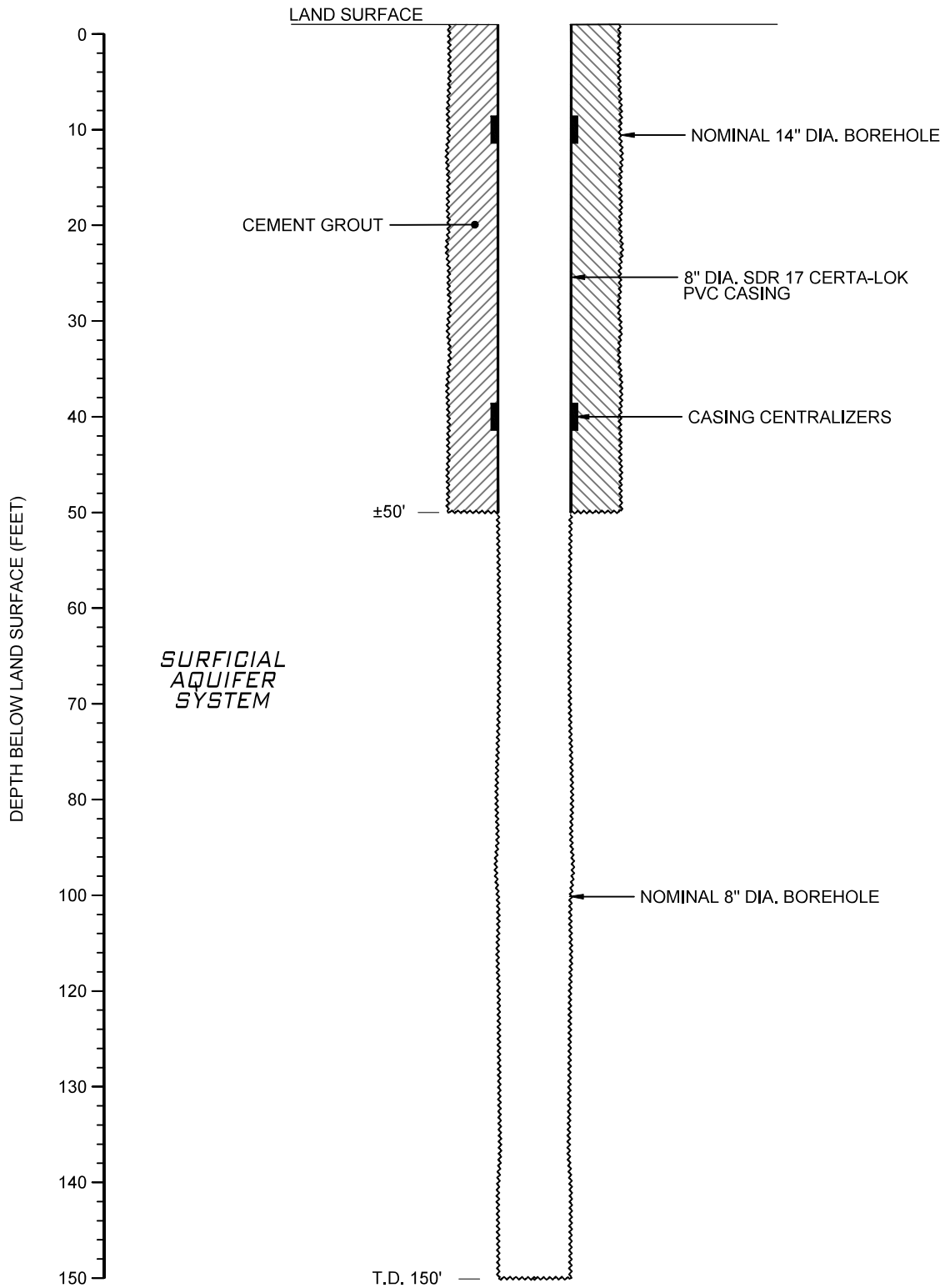


FIGURE 4- SCHEMATIC WELL CONSTRUCTION DIAGRAM FOR SURFICIAL AQUIFER TEST WELLS.

SANDSTONE AQUIFER OBSERVATION WELL

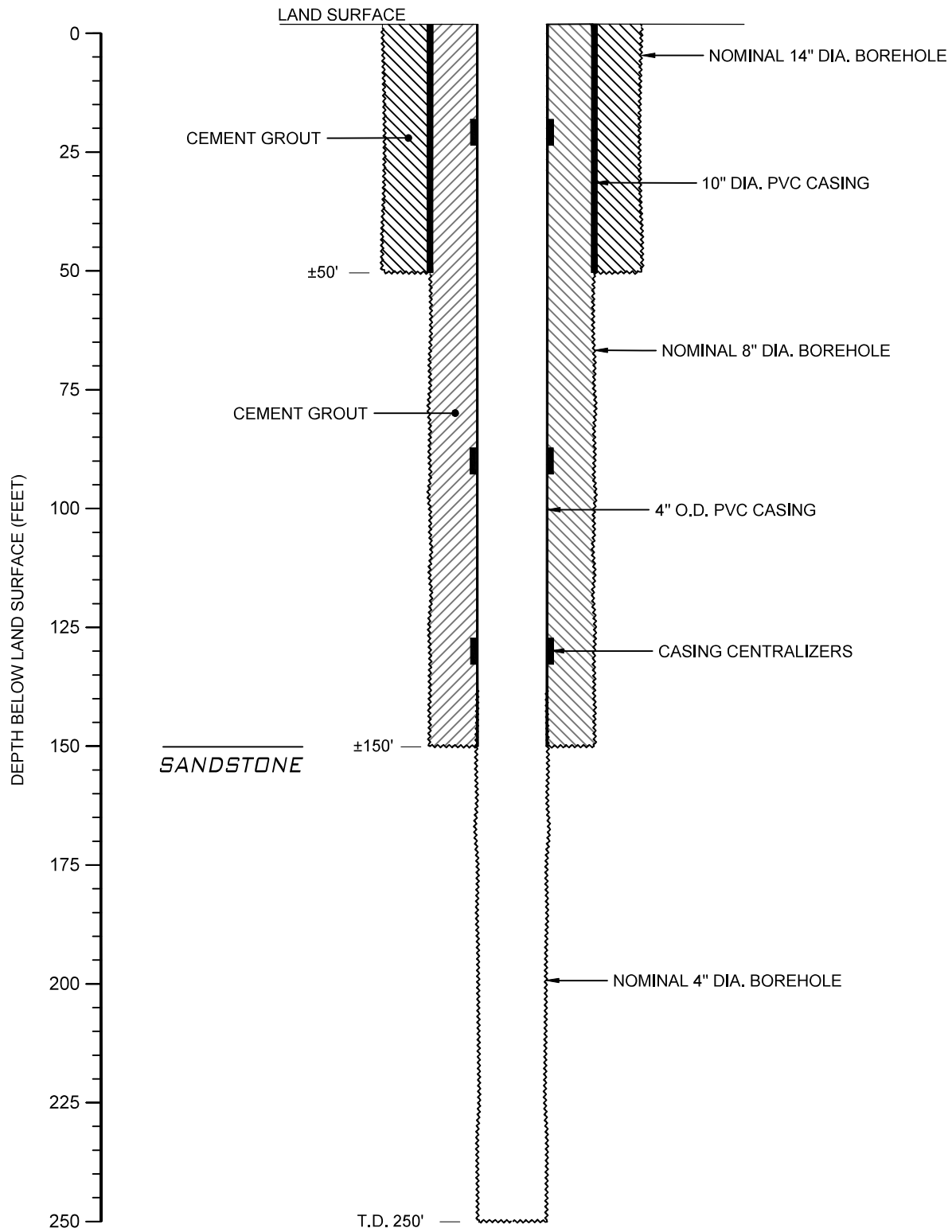


FIGURE 5- SCHEMATIC WELL CONSTRUCTION DIAGRAM FOR SANDSTONE AQUIFER OBSERVATION WELL.

**SURFICIAL AQUIFER
OBSERVATION WELL**

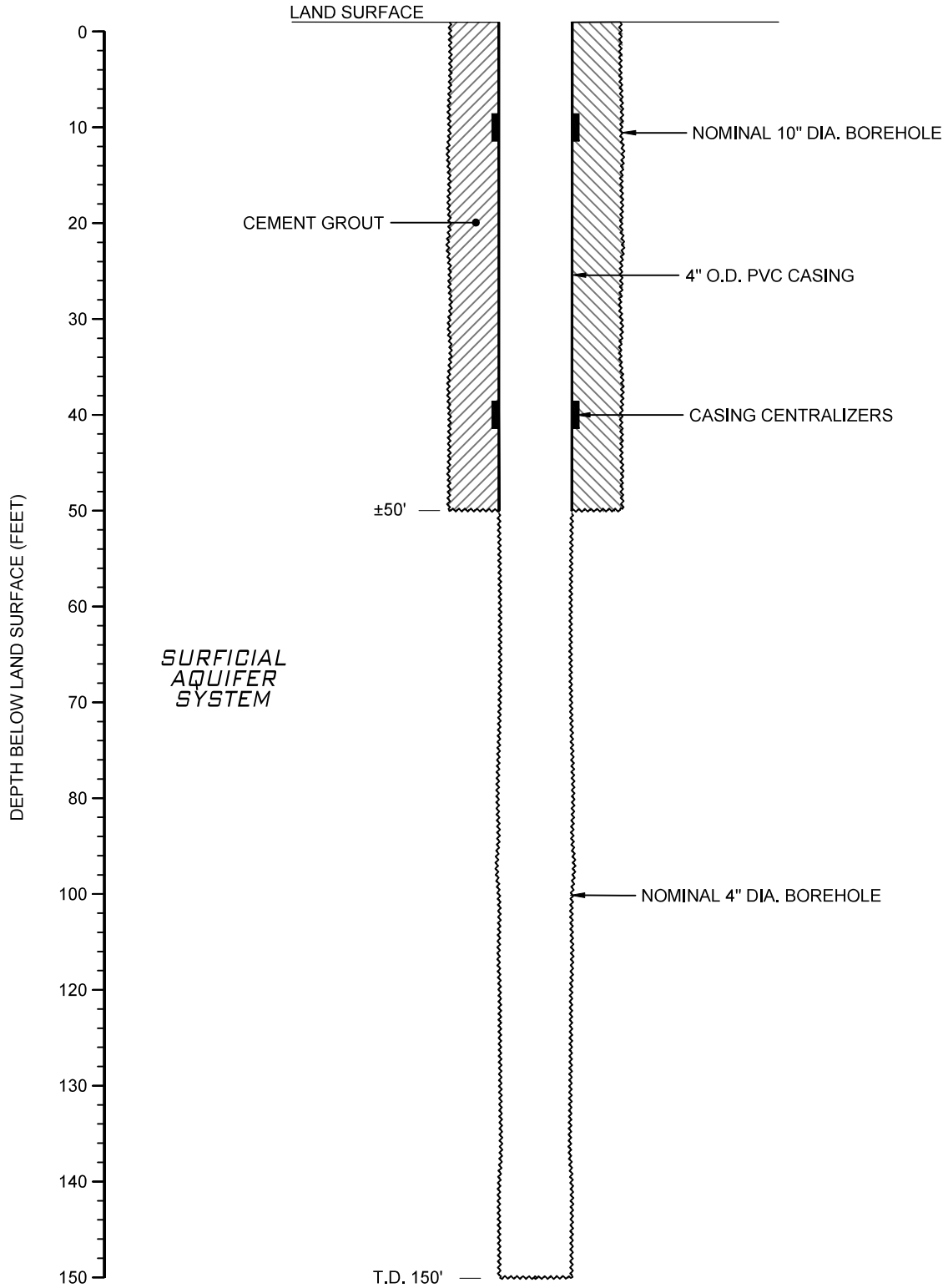
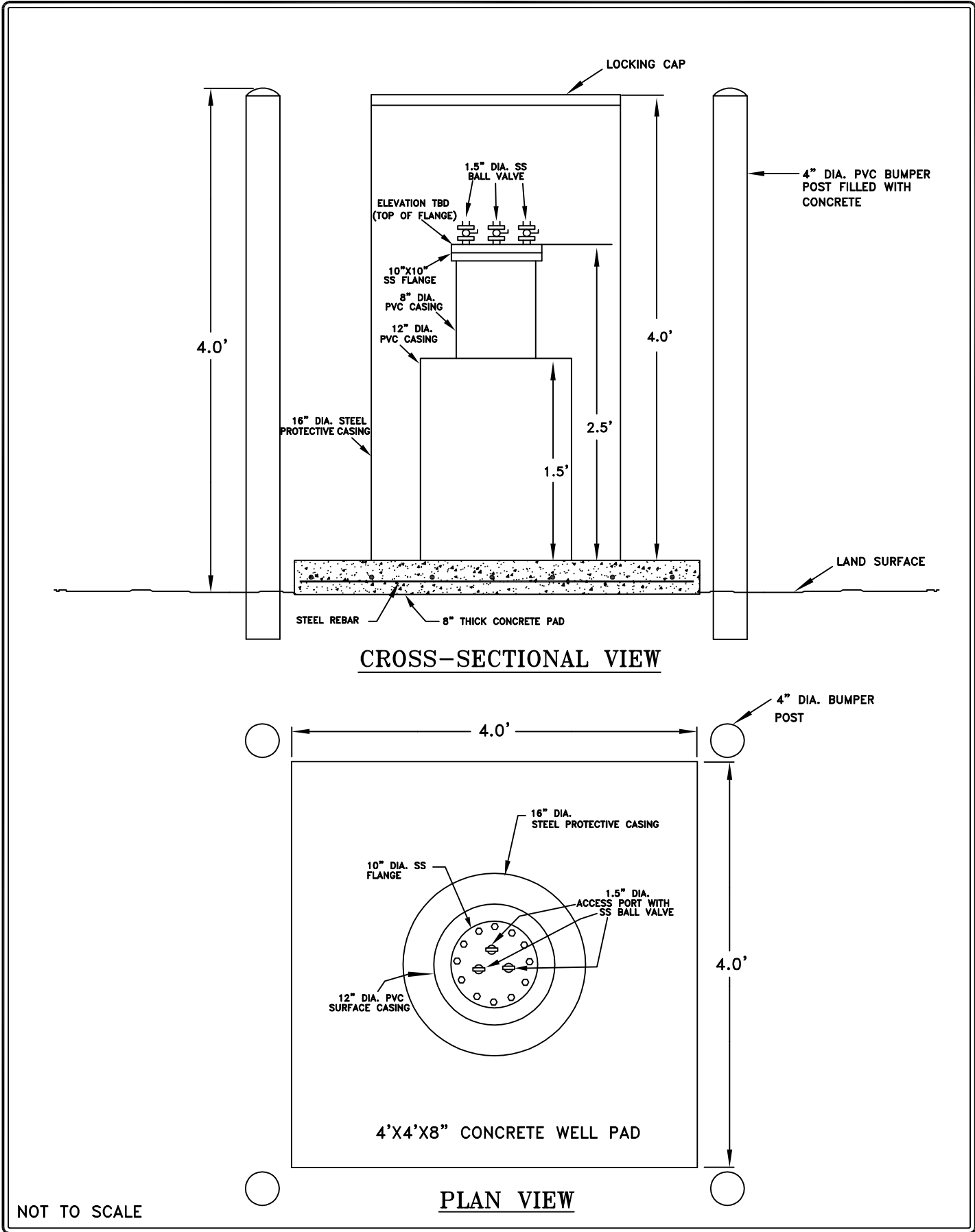


FIGURE 6- SCHEMATIC WELL CONSTRUCTION DIAGRAM FOR SURFICIAL AQUIFER OBSERVATION WELL.



CROSS-SECTIONAL VIEW

PLAN VIEW

NOT TO SCALE


	PROJECT NAME: Comprehensive Hydrogeologic Study
	PROJECT NUMBER: 22-295 DATE: 2/9/2022

FIGURE 7 – PLAN AND CROSS-SECTIONAL VIEW FOR TEST WELL WELLHEAD.