

APPENDIX G

SPECIFICATION FOR BEDROCK WELL DEVELOPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Appendix covers the development of each of the newly-installed bedrock monitoring wells. Development methods will include swabbing, bailing, and pumping. The CONTRACTOR shall comply with all applicable permits, laws, and regulation in disposing of drilling fluids and water generated during well development.

1.02 SUBMITTALS

- A. The CONTRACTOR shall maintain a daily record of the static water level, pumping water level, discharge rate, time, and sand content to be submitted to the ENGINEER daily.

1.03 MEASUREMENT AND PAYMENT

- A. Payment for mobilization of all of the necessary equipment tools and personnel to conduct the development operations as specified herein shall be at the price bid per well.
- B. Payment for well development will be made at the unit price bid per hour regardless of which type of development activity is used with 30-minute intervals as the smallest unit of recorded time. The time recorded for payment shall commence when the equipment has been set up and is placed in operation and shall end when development, pumping, or bailing are stopped at the direction of the ENGINEER.
- C. Payment for well development will include all disposal of fluids in accordance with the work specified in this section.
- D. No payment will be made for delays resulting from (1) equipment stuck in the hole; (2) equipment breakdown; (3) arranging major drilling, pumping or testing apparatus; or (4) failure to conduct the operations in a diligent and workmanlike manner by which the desired results could ordinarily be expected.

PART 2 PRODUCTS

2.01 DISPERSING AGENT

- A. The dispersing agent shall be a non-phosphate based product such as Bentonite Mud Remover (BMR) as manufactured by Colloid Environmental Technologies Company, or approved equal. The CONTRACTOR shall mix and add the BMR as recommended by the manufacturer. If organic polymer drilling fluid additives have been permitted by the ENGINEER and used during the drilling, the CONTRACTOR shall provide all other materials and equipment required to break down and remove those additives from the well production zone according to recommendations of the additive manufacturer.

2.02 SWAB

- A. Swabbing of the well shall be done with both close fitting single or double swabs whose outside diameter shall be such that the swab fits snugly within the screen, but not so tight as to become stuck or damage the screen

2.03 SAND BAILER

- A. The sand bailer shall be capable of drawing solid material from the well bottom into the bailer for removal of sediment from the well shall be provided.

2.04 PUMP

- A. The pump furnished will be a submersible type, of a diameter small enough to be installed inside the 5-inch schedule 80 PVC well without binding or sticking. The pump shall be capable of pumping up to 30 gallons per minute (gpm) at 200 feet of head or as recommended by CONTRACTOR and approved by ENGINEER. The pump shall not be equipped with a foot valve, which would prevent back spin and interfere with surging. A satisfactory throttling device shall be provided so that the discharge can be reduced as necessary.

2.05 DISCHARGE LINE AND METER

- A. The discharge line shall include an in-line meter with 6-digit, straight reading totalizer, registered in units of gallons, together with a rate of flow indicator dial that reads in gallons per minute, and is suitable for a flow range of 5 to 50 gpm. A check valve shall be required on the surface discharge line to minimize water backflow into the well.

PART 3 EXECUTION

3.01 DEVELOPMENT WITH SWAB AND BAILER

- A. The CONTRACTOR shall commence development by swab no earlier than 24 hours after completion of the annular seal.

If needed, during development, at the direction of the ENGINEER, the CONTRACTOR shall inject a solution of dispersing agent into the screened sections in a manner acceptable to the ENGINEER. The dispersing agent shall be premixed with water before introduction into the well. After the solution has been added, clean water shall be added to the well to force the solution through the screen into the formation.

- B. Swab development shall proceed from the top of the screen to the bottom of the screen.
- C. Following development with the swab the CONTRACTOR shall bail sediment from the bottom of the well as required.
- D. Alternating periods of swabbing and bailing development shall continue until all sand and mud have been washed through screened sections of the well to the satisfaction of the ENGINEER. Upon completion of this procedure, the well shall again be bailed or air lifted clean of all accumulated sediment to its full depth.

3.02 DEVELOPMENT AND WELL PERFORMANCE TESTING WITH PUMP

- A. After completion of swabbing/bailing well development, the CONTRACTOR shall commence well development by using a pump.
- B. The quantity of water being pumped from the well at commencement of development pumping shall be limited and gradually increased as the water clears. From time to time, the pump shall be stopped and the water in the pump column allowed to flow back through the pump bowls and through the screened sections into the aquifers. This procedure, with increasing pumping rates, shall be repeated as development of the well continues and shall be done in a manner satisfactory to the ENGINEER.
- C. Development of the well shall continue until the specific capacity has been maximized, all drilling fluids have been removed and the well produces not more than 5 parts per million of sand by volume 5 minutes after surging at the maximum pumping rate for the well, or as approved by ENGINEER.
- D. The rate of sand production shall be measured during the development by the CONTRACTOR using an Imhoff Cone, or other equivalent method acceptable to the ENGINEER. The sand measurement device shall be furnished by the CONTRACTOR. The results of all sand production tests shall be expressed in parts per million at 5-minute intervals and shall be provided to the ENGINEER immediately. The final sand production test shall be conducted in the ENGINEER's presence.
- E. After completion of development pumping, the CONTRACTOR shall measure the depth of the well to determine the amount of sediment deposited in the bottom.
- F. After the well development pumping has been completed and the acceptance criteria met. An aquifer performance test will be performed by leaving the development pump in the well, then resuming pumping after the water level in the well has recovered to within 95 percent of its predevelopment static level. The test will consist of pumping the well at a constant sustainable rate to be determined by the engineer after the development pumping phase for a period of up to 8 hours. The CONTRACTOR will allow ENGINEER to install a water level transducer and may elect to remove the development pump and reinstall it or another pump at a later time to perform the test. However, no additional payment will be made for reinstalling the test pump.

END OF APPENDIX G