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# WELL SPECIFICATIONS

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## **SECTION 00001 - MOBILIZATION, CLEANUP, and CONTRACTOR REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.1 WORK INCLUDES**

- A. This section covers the work necessary to move in and move out personnel and equipment, set up and remove drill rigs and temporary facilities, permit and install the City of Alamosa's (CITY or OWNER) Grading, Erosion, and Sediment Control facilities, grade and maintain road to well site, and clean up the site completely.

### **PART 2 EXECUTION**

#### **2.1 GENERAL**

- A. Prior to setting up the drilling equipment and preparing the site for drilling and testing operations, the CONTRACTOR must obtain all permits required by the CITY for conducting drilling operations at the CITY site. These may include, but are not limited to, a Temporary, Erosion and Sediment Control (TESC) permit and an access permit. Permitting may also require a traffic control plan. The OWNER will sign any necessary permits that require the OWNER's signature within five (5) business days of the request by the CONTRACTOR. Copies of all required permits will be submitted to the OWNER and ENGINEER. All facilities required to be installed prior to mobilization to the site by the applicable permits shall be installed prior to the CONTRACTOR mobilizing drilling equipment to the site. All facilities required by the CITY shall be maintained by the CONTRACTOR throughout the length of the contract or as required by the permits.
- B. The driller shall attend a pre-drill meeting with the ENGINEER and OWNER prior to mobilizing to the site. The purpose of the pre-drill meeting is to "drill the well on paper" prior to drilling and constructing the well.
- C. Set up well drilling equipment within the area designated by the ENGINEER at the well site. Accomplish all required work in accordance with applicable portions of these Specifications. Drilling activities will be in a specific localized area with several logistical challenges including nearby power lines, natural gas lines, water treatment lines, the water tower, additional buildings, parking considerations, and the generally tight quarters of the water treatment site.

- D. The CONTRACTOR shall remove all mud and sediments as necessary from the mud pit to retain all turbid fluids from exiting the construction site during all construction, development, and testing activities. Control and disposal of the evacuated mud and sediments from the mud pit shall be conducted in accordance with the applicable county or other federal, state, or local regulatory requirements.

## 2.2 ACCESS ROAD MAINTENANCE

- A. The entire road to the well site shall be maintained and repaired as necessary to maintain the current conditions throughout the project operations.

## 2.3 SECURITY FENCE AND SOUND WALLS

- A. If required by the CITY the CONTRACTOR's security fence shall be constructed at the well site for the protection of materials, tools, and equipment of the CONTRACTOR and subcontractors. A gate shall be installed to secure the area when there are no activities or personnel at the site. At the completion of the work remove fence from the site and restore the area.
- B. Under the CITY's discretion CONTRACTOR shall furnish, install, maintain and subsequently remove noise abatement equipment in all directions that face towards a residential area. The CONTRACTOR shall submit a drawing of a proposed sound mitigation plan to the CITY and ENGINEER for approval prior to mobilization if sound walls are needed.

## 2.4 CONTAMINATION PRECAUTIONS

- A. The CONTRACTOR shall exercise care to prevent the contamination of the project area or the surrounding environment during all construction and testing activities. Petroleum fuels and lubricants are to be stored and handled in accordance with state and local regulations. The CONTRACTOR shall be responsible for the remediation or restoration that may result from his construction activities. The CONTRACTOR shall be responsible keeping all access roads free from dirt and debris tracked away from the project area by vehicles traveling to and from the site via sweeping or other means.
- B. Waste oils and construction rubbish shall be promptly and properly

disposed of and shall not be allowed to accumulate at the site.

## 2.5 CLEANUP OF CONSTRUCTION AREAS

- A. Upon completion and acceptance of the wells, remove from the site the drill rig and equipment, mud tanks, and all debris, unused materials, temporary construction buildings, and other miscellaneous items resulting from or used in the operations. Replace or repair any facilities that have been damaged during the construction work. Restore the wellsite as near as possible to its original condition including grading and seeding as required under Douglas County or other federal, state, or local regulatory or permit requirements.
- B. Included in the cleanup of the well construction site will be the reclamation of the mud pit areas (if used) used in the drilling operations. All fluids and unstable soils shall be removed from the mud pit areas and trucked away. Fly ash (stabilizer) and clean backfill materials approved by the ENGINEER shall be placed in the mud pit area. The mud pit shall be backfilled such that normal vehicle traffic can be maintained over the reclaimed mud pit areas at the conclusion of the construction activities at the drill sites.

## Part 3 CONTRACTOR QUALIFICATIONS & REQUIREMENTS

### 3.1 GENERAL

- A. The CONTRACTOR shall have no less than five (5) years of experience using reverse circulation rotary drilling in bedrock environments deeper than 1,000 feet. In addition, the CONTRACTOR must have successfully completed no less than five (5) separate well installation projects within the past two (2) years, using reverse circulation rotary drilling, and involving installation of potable water production wells with similar casing dimensions and well depths as specified herein. The CONTRACTOR shall provide with its bid, a list of no less than three municipal client references for well installations within the past five years. The CONTRACTOR shall also provide with its bid, a list and details of all liens or lawsuits that the CONTRACTOR has been involved with, which are associated with a well construction projects within the past five years. At the discretion of the OWNER, the CONTRACTOR bid may be rejected as non-responsible on the basis of previous or ongoing liens or lawsuits.
- B. The CONTRACTOR shall hold: (1) a valid Colorado Well Driller's License in the reverse circulation category; (2) a Colorado Registrar of

Contractor License type; and (3) all other licenses required by Federal, State, County, or Municipal rules and regulations. SUBCONTRACTORS may also hold a valid Colorado Well Driller's License in addition to that of the CONTRACTOR, but not in lieu of the CONTRACTOR'S Well Driller's License. In addition, the CONTRACTOR shall be named as "Principal" on the Performance Bond and Payment Bond. The CONTRACTOR shall provide a copy of their Colorado Well Driller's License and a copy of their Colorado Registrar of Contractor License with the bid submittal.

- C. The CONTRACTOR shall employ only competent employees for the execution of 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, or making connections). 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, well screen, filter pack sand, cement seal(s), and formation stabilizer). All operations shall be performed under the direct and personal supervision of a Colorado-licensed well driller. The CONTRACTOR shall assign a foreman (tool pusher) to oversee all work required by this specification. The foreman must be approved by the ENGINEER. After selection, the CONTRACTOR foreman shall provide to the ENGINEER a written certification that he has read and fully understands this technical specification prior to mobilization to the well site. The CONTRACTOR shall construct the supply wells in accordance with the 2 CCR 402-2 Rules and Regulations for Water Well Construction, Pump Installation, Cistern Installation and Monitoring and Observation Hole/Well Construction (RULES), and all other applicable Federal, State, County, or local regulations. Rejection of any materials, work, or equipment by the ENGINEER shall be at the CONTRACTOR'S expense, and at no cost to the OWNER. Replacement materials, work, or equipment that is in accordance with these specifications and approved by the ENGINEER will be paid for by the OWNER in accordance with the Bid Schedule.
- D. Should a well be lost due to any negligent action on the part of the CONTRACTOR (as determined by the ENGINEER), the well shall be abandoned at no cost to the OWNER and a replacement well shall be constructed in the immediate area. The ENGINEER will select the replacement well location. The replacement well shall be completed in accordance with all the terms and conditions stated herein. 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.

- E. If the loss of the well was not due to any negligent action of the CONTRACTOR, the ENGINEER may designate a replacement well location and the OWNER shall provide reimbursement for the replacement well on the basis of the unit costs presented in the CONTRACTOR'S Schedule A.
- F. If a work delay, deficiency of work performance and/or a material's 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 ENGINEER charges assessed to the OWNER as a direct result of the delay or deficiency. This includes delays due to equipment failure, if the ENGINEER determines that the equipment failure could have been prevented through proper maintenance.
- G. The ENGINEER may, at its discretion, reject CONTRACTOR work that does not meet these specifications or tolerances thereof, as determined by the ENGINEER. Any additional standby time or other costs incurred by the CONTRACTOR as a result of the rejection of any specified work provided by the CONTRACTOR or its SUBCONTRACTORS shall not be compensated by the OWNER and shall be the sole responsibility of the CONTRACTOR.
- H. The CONTRACTOR shall provide the ENGINEER with a statement of understanding indicating they have read and understand these technical specifications.

## **PART 4      PAYMENT**

### **4.1      GENERAL**

- A. Payment for all work, materials, and equipment specified in this section will be included as part of the lump sum bid amount stated in the CONTRACTOR's Bid Schedules A for MOBILIZATION AND CLEANUP and at the unit prices and lump sum bid amount stated in the CONTRACTOR's Bid Schedules A for MANDATORY ALTERNATE ITEMS for Road Maintenance, Drilling Mud/Fluids Removal, and TESC Permitting and Implementation.

**END OF SECTION**

## SECTION 00002 - DRILLING

### PART 1 GENERAL

#### 1.1 WORK INCLUDES

- A. This section covers the work, materials, and equipment necessary for drilling the CITY wells.

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. All equipment shall be in good working condition prior to use in the work. Operate and maintain equipment in conformance with the manufacturer's recommendations.
- B. The number of wells to be drilled and anticipated depth of the wells is specified in Table 1 – Well Permits Numbers and Target Depths.
- C. Drilling the CITY wells will penetrate unconsolidated alluvial basin fill with variable grain size distribution. The formations encountered will likely consist of interbedded sand, gravel, and clay.

**Table 1: Well Permit Numbers and ESTIMATED Target Depths**

| Well Name (-) | Permit Number (-) | Target Aquifer Name (-)    | Aquifer Thickness (ft) | Well Total Depth (ft) | Easting (NAD 83 UTM Zone 13 [m]) | Northing (NAD 83 UTM Zone 13 [m]) |
|---------------|-------------------|----------------------------|------------------------|-----------------------|----------------------------------|-----------------------------------|
| PW-02         | TBD               | San Luis Valley Basin Fill | 1500 +                 | 1310                  | 422997.29957                     | 4146856.48130                     |

#### 2.2 DRILLING EQUIPMENT

- A. Provide a reverse rotary drilling rig capable of completing the well as shown on the attached well construction drawings.
- B. Provide all tools, bits, and all other necessary equipment for drilling.

#### 2.3 DRILLING FLUID

- A. Provide all drilling fluids, water, and additives as required. Review fluids and additives with the ENGINEER prior to drilling (included in list of submittals).

- B. LRE recommends maintaining drilling fluid properties in accordance with AWWA A100 guidelines while drilling:
  - a. Weight (fluid density)—limits: 9.4–11.4 lb/gal (1,126–1,366 kg/m<sup>3</sup>)
  - b. Viscosity—limits: 32–40 s/qt (30–38 s/L) [clear water 26 s/qt (25 s/L)];
  - c. Filtration (wall cake and filtration loss)—limits: 3/32 in. (2.38 mm) with maximum 20-cc water loss in 30 mins
  - d. Sand content (solids larger than 200 mesh)—limits: 2–4 percent, by volume

#### 2.4 TEST AND SAMPLING EQUIPMENT

- A. Provide equipment for measuring drilling fluid properties.
- B. Provide sampling bags or containers.

### **PART 3 EXECUTION**

#### 3.1 DRILLING

- A. Notify the ENGINEER 5 days (Saturdays, Sundays, and holidays excepted) prior to drilling.
- B. Provide at all times a thoroughly experienced, competent, and licensed driller during all operations at the drill site.
- C. Drill the borehole of the dimensions and at the approximate location shown on the attached well construction drawing. The exact location will be determined by the ENGINEER in the field.
- D. The borehole shall be drilled so as to permit the installation of the casing screens and filter pack materials, if used, straight and plumb to the tolerances specified in Section 00004 CASING.
- E. Use only drilling fluids and additives specifically recommended by the manufacturer for use in water well drilling. Avoid contamination of the samples or the aquifer. Do not introduce muds, clays, or drilling aids into the wells or use lime, cement, organic matter, or other material to stop circulation losses of the drilling fluid, without reviewing the proposed program with the ENGINEER.
- F. The CONTRACTOR may check plumbness, out-of-roundness, and straightness of the drilled holes as the drilling progresses. Such checking shall not relieve the CONTRACTOR from requirements for testing as specified in Section 00004 – Casing.



### 3.2 COMPLIANCE WITH GOVERNMENTAL REGULATIONS

- A. Construct the well in strict conformance with all laws, rules, regulations, and standards related to the construction of wells in the State of Colorado and the CITY.

### 3.3 FORMATION SAMPLES

- A. Take representative formation samples between 5 feet below the ground surface to the full depth in the well. Samples shall be taken at each 10-foot level and each change in formation or material type. The method must yield samples that are representative of the actual depth to which drilling has progressed.
- B. Each sample shall be approximately 1 quart in volume. Place each sample in a container labeled with the date, well identification, and depth from which the sample was taken clearly marked on the container. Submit sample to the ENGINEER or store safely on site immediately (included in list of submittals).

### 3.4 PROTECTION OF WATER QUALITY

- A. Take all necessary precautions to prevent contaminated water, gasoline, or other deleterious substances from entering the well, either through openings or by seepage through the ground surface. Maintain precautions during and after construction of the well until accepted by the OWNER.

### 3.5 PROTECTION OF SITE

- A. The CONTRACTOR will be responsible for clearing and grubbing of existing vegetation and debris within the well site work area. 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 an adequate roll-off bin to contain all debris and trash collected at the site. All litter and debris will be cleaned up daily and placed in the roll-off bin for off-site disposal. The CONTRACTOR is responsible for the location and clearance of all underground utilities. The CONTRACTOR shall be responsible for any damage resulting from its failure to identify and avoid underground utilities.
- B. The CONTRACTOR shall submit to the OWNER a site plan for approval

depicting the location of equipment, materials, spoils, and fencing. The drawing shall note the following: excavation of borings, any significant surface disturbances, delivery methods, supply lines, and water and cuttings disposal methods. This plan must be approved by the OWNER prior to mobilization.

- C. A plastic tarp and berm shall be placed beneath the drilling rig and kept in good repair, until demobilization to protect the site against oil or hydraulic fluid spills or leaks and will remain beneath the rig. A plastic tarp and berm shall also be placed beneath other stationary equipment such as air compressors and fuel tanks. Compressed air introduced into the well during drilling, sampling, or well development must be treated by passage through a carbon or coalescing filter to remove organic contaminants (e.g., compressor lubrication oil).
- D. The CONTRACTOR is responsible to apply water for dust control to work areas and access roads as required to meet State, County, or local dust control ordinances, or as requested by the ENGINEER or OWNER. The CONTRACTOR shall meet the requirements for dust control, including permitting, at its own cost.
- E. Circulation of drilling fluids during the drilling and construction phases of the project will be conducted within an aboveground tank(s).
- F. Discharge (e.g., drilling, aquifer testing, development) operations shall be conducted such that they do not cause damage to property, contamination of wells or waterways, or creation of a nuisance. For bidding purposes, the CONTRACTOR should plan to discharge all fluids at a location specified by the ENGINEER or OWNER, within 100 to 500 feet of the well site. After completion of the work, the CONTRACTOR shall remove all debris, oil-stained dirt, waste, trash and unused materials or supplies and shall obliterate all temporary construction facilities such as temporary work areas, temporary structures, 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 (on the groundwater surface) resulting from the use of test pumping equipment shall be removed prior to final acceptance of the well. The ENGINEER must approve cuttings disposal and site cleanup. Discharge operation may include hauling materials off site.

### 3.6 DRILLING FLUID CONTROL PLAN

- A. The CONTRACTOR shall provide a drilling fluid control plan to the

ENGINEER prior to the start of drilling (included in list of submittals). 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. The drilling fluid control plan must be approved by the ENGINEER. If available, drilling fluid additives should be certified by the National Sanitation Foundation (NSF) and approved by the Colorado Board of Examiners.

### 3.7 DRILLING FLUID TESTING

- A. The CONTRACTOR shall retain an experienced drilling fluid engineer (included in list of submittals). The CONTRACTOR'S selection of a drilling fluid engineer will be subject to approval by the ENGINEER. The drilling fluid engineer will be available within a 2-hour travel time of the site during all drilling and well construction operations. Drilling fluid tests will be required 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 API Standard RP 13B, "Standard Procedures for Testing Drilling Fluids." Samples tested are those collected at the rig discharge line, with care taken to assure a true and representative sample. Drilling fluid tests shall be conducted at a minimum of: (1) every 24 circulating hours; (2) when significant changes to the drilling fluid are made; (3) whenever conditions appear to have changed or when problems arise; or (4) at the request of the ENGINEER. A Marsh-type viscosity funnel and a mud scale will be available at the well site during all well construction operations and, upon request, will be made available to the ENGINEER.
- B. The CONTRACTOR shall maintain and make available current records at the 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., type, amount, time, and depth); and (3) variances or modifications from the agreed upon drilling fluid control program such as time, depth, reason, and authorization.
- C. The CONTRACTOR is responsible for maintaining an adequate supply of drilling fluid additives (including lost circulation material) at the drilling site and for the removal of all drilling fluids and additives from the borehole during development of the well. The above-ground mud tank at the site

must be of adequate size, with sufficient baffling to adequately remove suspended solids prior to discharge.

### 3.8 GENERAL REQUIREMENTS

- A. During the drilling and reaming of the borehole and the installation of the well, the CONTRACTOR will be responsible for minimizing the chemical and biological disturbance of the vadose zone and saturated aquifer matrix. The use of certain organic drilling fluid materials (such as starch, guar, or cottonseed hulls) will not be accepted for drilling, although some organic polymer additives may be allowed. Material Safety Data Sheets (MSDS) from the manufacturer for all drilling fluid additives must be provided to the ENGINEER for review prior to their use. The drilling fluids (polymers or muds) must be National Sanitation Foundation (NSF) 60 approved. The ENGINEER reserves the right to reject any and all proposed additives. The CONTRACTOR shall be responsible for maintaining the quality of the drilling fluid to ensure:
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, swelling clays, lost circulation),
  5. protection of the integrity of the boring during the drilling and zonal sampling/testing operations (if requested by OWNER), and
  6. complete and accurate geophysical logging prior to reaming of pilot holes or once the hole has reached total depth if a pilot hole is not drilled.
- B. 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. The above-ground mud tank(s) at the site shall have a minimum depth of 6 feet and a total volume no less than that of the reamed borehole. The above-ground mud tank(s) shall contain at least one baffle and sufficient solids control equipment, to assist with the separation of cuttings and suspended solids from the drilling fluid. The specific dimensions and design of the above-ground mud tank(s) must be approved by the

ENGINEER.

### 3.9 LOST CIRCULATION

- A. During the drilling and reaming of the borehole, if there is no return of circulation drilling fluid for a period of at least one continuous hour due to no fault of the CONTRACTOR, then the OWNER will compensate the CONTRACTOR for the period of drilling under lost circulation conditions, at the CONTRACTOR'S hourly rate in lieu of footage compensation. If and when lost circulation conditions are encountered due to hydrogeologic conditions, the CONTRACTOR shall immediately notify the ENGINEER so that the OWNER is informed of the situation and potential costs to be incurred. Immediately upon the occurrence of Lost Circulation Conditions, the ENGINEER will document the times, quantities, and circumstances of Lost Circulation Conditions during each occurrence. Failure of the CONTRACTOR to promptly notify the ENGINEER of Lost Circulation Conditions 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 OWNER will provide compensation at a rate of cost plus 10-percent markup to the CONTRACTOR for all drilling fluid materials and additives used during the period of lost circulation. The OWNER shall not incur costs for drilling fluids or additives placed in the borehole during non-lost circulation conditions. If lost circulation is the result of CONTRACTOR'S operations or activities (e.g., excessive fluid weight), all costs to regain circulation shall be borne by the CONTRACTOR.
- B. "Lost Circulation Conditions" under this Section shall apply only when there 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, due to no fault of the CONTRACTOR.
- C. 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 Conditions 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, as described in this paragraph.

### 3.10 RATE OF PENETRATION

- A. During pilot hole drilling (if applicable), reaming operations, and borehole drilling operations, if a formation is encountered that results in a penetration rate of four feet per hour or less for a period of at least two continuous hours, while at least 1,500 pounds per diameter inch is applied to the drill bit, then the OWNER will compensate the CONTRACTOR for the period of hard drilling conditions at the CONTRACTOR'S hourly rate, in lieu of footage compensation. The CONTRACTOR is responsible to notify the ENGINEER immediately upon the occurrence of Low Penetration Rate Conditions, and to document the times, quantities, and circumstances of Low Penetration Rate Conditions during each occurrence. Failure of the CONTRACTOR to promptly notify the ENGINEER of Low Penetration Rate Conditions will void the CONTRACTOR'S opportunity to implement this clause. The ENGINEER will notify the OWNER immediately when Low Penetration Rate Conditions are occurring, so that the OWNER can assess potential costs to be incurred. Also, the OWNER will provide compensation at a rate of cost plus ten percent markup to the CONTRACTOR for all drilling bits and other materials used during the hard rock drilling conditions. The CONTRACTOR will credit the prorated values of used drilling bits to the OWNER. The conditions of this Section shall apply from the beginning of the time period of low penetration (less than four feet per hour), and shall continue only until such time as drilling is resumed at a rate of four feet per hour or greater. Upon invocation of this penetration rate clause, the CONTRACTOR, if requested, will trip the drill string out of the hole for inspection of the drill bit by the ENGINEER. The conditions of this Section shall apply only if the ENGINEER'S inspection of the drilling bit does not indicate excessive bit wear that would substantially decrease the penetration rate. In the event that the drill bit inspection indicates that this Section applies, the CONTRACTOR will be compensated at the standby rate identified on the Bid Schedule for the time expended to inspect the drill bit.

### 3.11 RATE OF PENETRATION (ROP) LOG

- A. During the drilling of the borehole, a time log shall be kept showing the actual penetration time required to drill each foot of the borehole. 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 and rotation speed denoted as revolutions per minute (RPM) during the drilling of the various types of formation throughout the borehole. This log shall be available for review by the ENGINEER throughout the drilling program and shall be delivered to the ENGINEER upon completion of drilling.

### 3.12 DAILY DRILLER'S REPORT

- A. During the drilling of the borehole, a detailed driller's report shall be maintained and provided daily to the ENGINEER at the wellsite. The daily driller's report shall be recorded on forms approved by the International Association of Drilling Contractors (IADC) and the American Petroleum Institute (API). The ENGINEER must also approve the daily driller's report forms. The report shall give a complete description of all formations encountered, number of feet drilled, number of hours on the job, shutdown due to breakdown, length and type of casing set, volumes of gravel pack and annular seal installed, and such other pertinent data as may be requested by the ENGINEER. CONTRACTOR personnel will submit the report electronically to the ENGINEER daily.

### 3.13 DRILLER'S LOG

- A. The log shall accurately describe the geologic materials and depths encountered, the presence or absence of water, depths of lost circulation zones and methods of regaining circulation, drilling rates, time, depth, description of any unusual occurrences or problems during drilling, and diameters and lengths of casing installed. Keep the log up-to-date with the progress of drilling. Keep a copy at the drill site for inspection by the ENGINEER. Use reproductions of the Daily Drilling Report located at the end of this section, or equal. The log shall include the reference point for all depth measurements, a generalized description of each formation encountered, the depth at which each formation is encountered and the thickness of each formation. The lithologic log prepared by the ENGINEER will be made available to the CONTRACTOR to assist in the preparation of the driller's log. A copy of the driller's log shall be furnished electronically to the ENGINEER daily.

- B. Prepare and submit a final log which shall include a geologic log, borehole diameters, depth of the bottom of the casing and/or the bottom of the borehole, casing diameters and wall thicknesses, cemented zones, perforated or screened interval(s), type, size, and quantity of gravel pack installed, amount of sand removed during development, and other information from the daily logs pertinent to the wells' construction. File all records and reports with the proper agencies required by federal, state, and local codes or regulations.

### 3.14 DISPOSAL OF CUTTINGS AND WATER

- A. Dispose of all cuttings, water, or other material removed by drilling operations that are not required to complete the work in accordance with OWNER Temporary, Erosion, and Sediment Control (GESC) permit conditions or other federal, state, or local regulatory requirements. Costs for removal of cuttings and drilling fluids will be in accordance with the specifications detailed in SECTION 00001 – MOBILIZATION AND CLEANUP.

## **PART 4 PAYMENT**

### 4.1 GENERAL

- A. Drilling will be measured in linear feet of hole drilled, to the nearest foot.
- B. Payment for all work, materials, and equipment specified in this section will be made at the unit price per foot drilled as stated in the CONTRACTOR's Bid Schedule for DRILLING and the lump sum bid amount stated in the CONTRACTOR's Bid Schedules for MANDATORY ALTERNATIVE ITEMS.



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## SECTION 00003 - GEOPHYSICAL LOGGING

### PART 1 GENERAL

#### 1.1 WORK INCLUDES

- A. This section covers the work, materials, and equipment necessary for geophysical logging the borehole at each of the CITY wells.

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. Provide continuous-recording geophysical logging equipment capable of running spontaneous potential, long and short normal resistivity, gamma ray, conductivity, caliper, compensated density, and include other logs as needed as provided by a commercial logging service such as Phoenix Surveys, COLOG, or equal.

### PART 3 EXECUTION

#### 3.1 GENERAL

- A. Logging shall be done as soon as possible after drilling the well bore. The logging interval shall be the total depth of the borehole or less as determined by the ENGINEER. All logs shall be recorded and reported in graphic form. The CONTRACTOR will supply the ENGINEER with electronic (PDF, TIFF, and .LAS files) and hard copy completed geophysical logs.
- B. It is the responsibility of the ENGINEER to: (1) select vertical scale units for the log commensurate with the purpose of the log, (2) see that all logs are recorded at the highest sensitivity that is consistent with a minimum of off- scale deflection, and (3) see that scales, calibration and standardization, and other pertinent data are recorded on each log.

#### 3.2 GEOPHYSICAL LOGGING

- A. Geophysical logging (e.g., deep and medium resistivity, single point resistance, natural gamma, and caliper at a minimum to the total depth of

the boring shall be conducted at the cessation of drilling. If NMR/BMR logging is required this will be indicated on the Mandatory Alternative attached with Schedules A, B, and C. If a pilot hole is drilled, once the pilot boring has been reamed to its final diameter, a second 4-arm caliper log will be conducted to confirm the final borehole diameter and annular fill/seal volume requirements. During geophysical logging activities, the CONTRACTOR will be compensated at its hourly rig rate, as indicated in the CONTRACTOR'S bid.

- B. Geophysical logging shall be conducted in a continuous manner throughout the entire length of both the pilot (if a pilot hole is drilled) and reamed borings. For the focused guard log, the tool shall be decentralized to maintain a minimum standoff distance of one and one-half (1½) inches. A maximum standoff distance of two and one-half (2½) inches must be available upon request by the ENGINEER.
- C. The CONTRACTOR 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 logger in rigging of the geophysical survey equipment. The CONTRACTOR shall ensure that the logging tools can be run to the total depth of within the pilot borehole and reamed boring (if applicable), and the final boring, without interference by obstructions or tight sections in the boring.
- D. At the request of the ENGINEER, the geophysical logging SUBCONTRACTOR shall conduct repeat sections in intervals of the borehole selected by the ENGINEER. The repeat logging intervals will not exceed 50 feet per log. All costs associated with logging of repeat sections will be the sole responsibility of the CONTRACTOR.

## **PART 4      PAYMENT**

### **4.1      GENERAL**

- A. Payment for all work, materials, and equipment specified in this section will be made at the unit price as stated in the CONTRACTOR's Bid Schedule A for GEOPHYSICAL LOGGING. Note that NUCLEAR or BOREHOLE MAGNETIC RESONANCE LOGGING is included as a separate line item on the Mandatory Alternate Items Bid Schedule.

**END OF SECTION**

## SECTION 00004 - CASING

### PART 1 GENERAL

#### 1.1 WORK INCLUDES

- A. This section covers the work, materials, and equipment necessary for furnishing, installing, and testing the straightness and plumbness of the well casing and for furnishing blank casing for each well, complete.

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. Provide all materials and equipment necessary for joining and installing the casings as specified.

#### 2.2 SURFACE CASING AT WELL

- A. Use pipe of sufficient strength to hold the drilled hole open until the grouting is completed and to be able to withstand pulling.
- B. The casing shall meet the specifications in Table 2 – Surface Casing Requirements. Surface casings shall extend to a minimum depth specified in Table 2 – Surface Casing Requirements or as determined by the ENGINEER. Confirmation of the geologic material encountered during drilling for the surface casing must be confirmed by the ENGINEER prior to constructing the surface casing. Surface casings must be grouted in place as specified in Section 00007 GROUT SEAL.

| <b>Table 2: Surface Casing Specifications</b>                         |  |
|---|--|
| <i>*Driller preference based on experience in basin fill drilling</i> |  |
| <b>PW-02</b>  |  |
| <b>Surface Borehole (in)</b>  | *40 to 48 inches                                     |
| <b>Surface Casing Outer Diameter, OD (in)</b>                         | *36.375 to 40.375                                    |
| <b>Surface Casing Inside Diameter, ID (in)</b>                        | *36 to 40  |
| <b>Wall Thickness (in)</b>  | 0.375  |
| <b>Material Type (-)</b>  | ASTM A139 Grade B steel or<br>ASTM A53 Grade B steel |
| <b>Weight (lb./ft)</b>  | 118.76   |
| <b>Length (ft)</b>  | <b>40</b>  |

#### 2.3 WELL AND BLANK CASING AT EACH WELL

- A. Provide all casing of the types, thicknesses, diameters, and

weights as specified. All casing shall be of new first quality material and free of defects in workmanship and handling.

- B. All Carbon Steel (“CS”) or Stainless Steel (SS) casing shall meet the specifications outlined in Table 3 – Blank Casing Specifications.
- C. The OWNER will provide a recommendation for purchasing CS or SS for the blank casing requirements (Not both). However, if CS is requested by the OWNER a dissimilar metal connector is required between the Blank Casing and Screen.

| <b>Table 3: Blank Casing Specifications</b>                                 |   |   |
|---|---|---|
| <i>*OWNER will choose a required casing type; both will not be required</i> |   |   |
| <b>Borehole (in)</b>  |   |   |
| <b>PW-02</b>  |   |   |
| <b>17.5</b>   |   |   |
| <b>*Blank Casing Type 1<br/>(Carbon Steel)</b>                              | <b>Blank Casing Outer Diameter, OD (in)</b>       | 12.75                                       |
|   | <b>Blank Casing Inside Diameter, ID (in)</b>      | 12.375                                      |
|   | <b>Wall Thickness (in)</b>                        | 0.375                                       |
|   | <b>Material Type (-)</b>                          | Low Carbon Steel                            |
|   | <b>Weight (lb/ft)</b>                             | 49.61                                       |
|   | <b>Length (ft)</b>                                | <b>*920</b>                                 |
|   | <b>Plumbness Requirements (in/100 ft)</b>         | 6.7   |
|   | <b>*Blank Casing Type 2<br/>(Stainless Steel)</b> | <b>Blank Casing Outer Diameter, OD (in)</b> |
| <b>Blank Casing Inside Diameter, ID (in)</b>                                |   | 12.375                                      |
| <b>Wall Thickness (in)</b>  |   | 0.375                                       |
| <b>Material Type (-)</b>  |   | 316L Stainless, ASTM<br>240M                |
| <b>Weight (lb./ft)</b>  |   | 49.58                                       |
| <b>Length (ft)</b>  |   | <b>*920</b>                                 |
| <b>Plumbness Requirements (in/100 ft)</b>                                   |   | 6.7   |

#### 2.4 FITTINGS AT EACH WELL

- A. Provide all fittings, drive shoes, and centering guides as shown on the attached well construction drawings or as necessary to complete the wells.
- B. A welded end cap shall be installed at the bottom of the well on the tailpipe casing section below the last screened interval to conform with the Drawings and these Specifications. The end cap shall be of the same material and thickness as specified for the well casing.

#### 2.5 STRAIGHTNESS AND PLUMBNESS

- A. Provide all materials and equipment necessary to perform the straightness and plumbness tests as specified. Test equipment shall

be in conformance with AWWA A100, except as modified by these Specifications.

### **PART 3 EXECUTION**

#### **3.1 GENERAL**

- A. Install specified casing in each hole straight and plumb as defined in the STRAIGHTNESS AND PLUMBNESS paragraph of this section.
- B. All casings shall be installed by a method appropriate to the attached well construction drawings, as selected by the CONTRACTOR.
- C. Casing lengths shall be joined watertight by a method appropriate to the material used, as selected by the CONTRACTOR, so that the resulting joint shall have the same structural integrity as the casing itself.
- D. If metallic casing is welded, the standards of the American Welding Society shall apply.
- E. If threaded and coupled joints are used, couplings shall be API or equivalent, made up so that when tight, all threads will be buried in the lip of the coupling.
- F. Attach centering guides spaced at 90-degree intervals around the casing 5 feet from the bottom end and thereafter every 40 feet in the screened section and at every 100-foot interval in the cased section above the uppermost screened interval.
- G. Casing which fails, collapses, or separates during construction shall be removed from the hole and repaired or replaced at the CONTRACTOR's sole expense.

#### **3.2 STRAIGHTNESS AND PLUMBNESS TEST**

- A. The wells shall be constructed and all casings and liners set round, straight, and plumb. To demonstrate compliance with the requirements, the CONTRACTOR may be required at the ENGINEER's request to perform the test described herein in conformance with AWWA A100, or equal. The test for straightness and plumbness shall be made following construction of the wells and before the test pump equipment is installed.
- B. Preliminary tests for plumbness and alignment shall be made by the

CONTRACTOR during the drilling of the pilot boreholes (if applicable), final boring, and after the construction and development of each well is complete. All plumbness and alignment tests will be conducted at the CONTRACTOR'S expense. During the drilling of the pilot or boreholes, inclinometer (A-1 Surest tool or equal) surveys shall be performed by the CONTRACTOR at no less than 60-foot intervals. A 3-degree unit shall be used with the inclinometer. Prior to the start of work on this project, the accuracy of the inclinometer tool must be verified to the approval of the ENGINEER, with a vertical or inclined test run at the land surface. In addition, the CONTRACTOR shall review the results of a magnetic deviation survey of the pilot hole and take required actions to meet the well plumbness and alignment requirements as described below.

- C. The straightness and plumbness shall be tested by lowering a section of pipe 40 feet long or a dummy of the same length into the well to a depth of at least the lowest anticipated pump setting. The outer diameter of the pipe or dummy shall be not more than 1 ½ inch smaller than the inside diameter of that part of the casing or hole being tested when the casing diameter is a nominal 10 inches or less. When the nominal diameter of the casing being tested is 12 inches or greater, 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. If a dummy is used, it shall consist of a rigid spindle with three rings, each ring being 12 inches in length. The rings shall be truly cylindrical and shall be spaced one at each end of the dummy and one ring in the center. The central member of the dummy shall be rigid so that it will maintain the alignment of the axes of the rings.
- D. The plumb line may be suspended from the drilling rig or from a tripod with a winch. An adjustable guide block shall be provided so that the test pipe or dummy will hang in the exact center of the top of the well casing. As the pipe or dummy is lowered into the hole, the deflection of the plumb line from the exact center of the casing will be measured every 10 feet.

### 3.3 STRAIGHTNESS AND PLUMBNESS REQUIREMENTS

- A. Should the test pipe or dummy fail to move freely throughout the length of the casing or hole to a depth of the lowest anticipated pump setting or should the well vary from plumb in excess of 2/3 the smallest inside diameter of that part of the well being tested per 100 feet of depth. Based on a nominal 10-inch inside diameter (0.365 inch wall thickness) or 12-inch inside diameter (0.375 inch wall thickness) and the projected permanent pump setting, the maximum allowable

closure distance for the well(s) is presented in Table 4 – Blank Casing Specifications and Table 5 – Casing Screen Specifications. The plumbness and straightness of the well shall be corrected by the CONTRACTOR at his sole expense. Should the CONTRACTOR fail to correct such faulty straightness or plumbness, the ENGINEER may refuse to accept the well. The ENGINEER may waive the requirements of this paragraph for plumbness if, in his judgment:

- (a) the CONTRACTOR has exercised all possible care in constructing the well and the defect is due to circumstances beyond his control,
  - (b) the utility of the completed well will not be materially affected,
  - (c) the cost of necessary remedial measures will be excessive. In no event will the provisions of this paragraph with respect to straightness be waived when it is anticipated that the well will be pumped with a line-shaft turbine pump or submersible pump.
- B. The “misalignment diameter” is defined as the horizontal distance between the well casing centerline (as measured by the gyroscopic survey) and the proposed pump centerline (represented by a “best-fit” straight line oriented to minimize its horizontal distance from the well casing centerline). The misalignment diameter shall not exceed one half ( $\frac{1}{2}$ ) the difference between the inside diameter (I.D.) of the casing and the outside diameter (O.D.) of the anticipated permanent pump column pipe. For these wells preliminary design (Figure 2), the misalignment diameter is represented by one half ( $\frac{1}{2}$ ) the annular distance between the 10-inch casing I.D. and the 4.5 or 3-inch pump column pipe O.D. Therefore, the misalignment diameter for the well design is 2.25 to 3.5 inches depending on the discharge pipe size. The alignment standard of this Section shall apply for these wells from the top of each well to the deepest projected pump setting depths in Table 4 – Blank Casing Specifications and Table 5 – Casing Screen Specifications.
- C. The OWNER may waive the requirements for alignment in this Section if it is determined by the ENGINEER that: (1) the CONTRACTOR has exercised all possible care in constructing the well and the defect is due to circumstances beyond the CONTRACTOR'S control; or (2) the utility of the completed well will not be materially affected.

#### 4.1 GENERAL

- A. Installed casing will be measured in linear feet to the nearest foot.
- B. Payment for providing and installing all well and blank casing will be made at the unit price per foot installed, as stated in the CONTRACTOR's Bid Schedule A for CASING.
- C. Full payment for providing and installing the surface casing, providing and installing all fittings, and performing the straightness and plumbness tests specified in this section shall be included in the unit prices as stated in the CONTRACTOR's Bid Schedule A for CASING.

#### 4.2 REFERENCE STANDARDS

- A. American Society for Testing and Materials:
  - 1. ASTM A53-83, Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
  - 2. ASTM A120-83, Pipe, Steel, Black and Hot-Dipped, Zinc-Coated (Galvanized) Welded and Seamless for Ordinary Uses
  - 3. ASTM A139
  - 4. ASTM A606
- B. American Water Works Association:
  - 1. AWWA A100-66, Standard for Deep Wells

**END OF SECTION**



## SECTION 00005 - WELL SCREEN ASSEMBLY

### PART 1 GENERAL

#### 1.1 WORK INCLUDES

- A. This section covers the work, materials, and equipment necessary for furnishing and installing the well screen assembly at each of the wells within the CITY.

#### 1.2 REFERENCE STANDARDS

- A. American Society for Testing and Materials: ASTM A312/A312M-92A, Seamless and Welded Austenitic Stainless-Steel Pipes and ASTM 240M

### PART 2 PRODUCTS

#### 2.1 WELL SCREEN

- A. Provide the well screens and all materials and equipment necessary to fabricate and install the well screen assemblies as specified.
- B. The well screens shall meet the specifications in Table 4 – Casing Screen Specifications. The OWNER will provide a recommendation for purchasing the wire wrapped or louvered casing requirements (Not both).

| <b>Table 4: Screen Casing Specifications</b>  |   |   |
|---|---|---|
|   | <b>*PW-02 Option 1</b>  | <b>*PW-02 Option 2</b>  |
| <b>Borehole (in)</b>                          | 17.5  | 17.5  |
| <b>Screen Casing Outer Diameter, OD (in)</b>  | 12.75   | 12.75   |
| <b>Screen Casing Inside Diameter, ID (in)</b> | 12.438  | 12.375  |
| <b>Wall Thickness (in)</b>                    | 0.312   | 0.375   |
| <b>Screen Type (-)</b>                        | Ful-Flo Louvered  | Wire Wrapped  |
| <b>Material Type (-)</b>                      | Type 316L stainless steel<br>(ASTM 240M, A312,<br>Schedule 12S) | Type 316L stainless<br>steel (ASTM 240M,<br>A312, Schedule 12S) |
| <b>Slot Size (in)</b>                         | 0.04  | 0.04  |
| <b>Length (ft)</b>                            | <b>380</b>  | <b>380</b>  |
| <b>Plumbness Requirements (in/100 ft)</b>     | 6.7   | 6.7   |

- C. The final screen lengths will be determined by the ENGINEER,

based on analysis of formation samples taken by the CONTRACTOR as specified in Section 00002 - DRILLING.

- D. The ENGINEER reserves the right to increase or decrease the length of the well screen, or to eliminate the screen entirely if the formation samples aquifer characteristics are undesirable.
- E. E. Within two (2) hours after the full depth of a well has been reached and the formation samples and geophysical logs have been received by the ENGINEER, the ENGINEER will decide whether or not a well screen shall be installed. If the ENGINEER decides that the well screen is to be installed, the ENGINEER will specify the lengths and locations of the well screen and the locations and lengths of blank casing sections within this same two (2)-hour period.

## 2.2 CENTERING GUIDES

- A. Provide centering guides for the well screen assemblies, as shown on the attached well construction drawings or as necessary to complete the wells. The centering guides for the well screens shall be of suitable material and construction to center the well screens in the borehole. The centering guides shall be selected by the CONTRACTOR and are subject to approval by the ENGINEER.

## 2.3 BLANK CASING

- A. See Section CASING for blank casing specifications.

## 2.4 FITTINGS AND PACKERS

- A. Provide all well screen assembly fittings and packers as shown on the well construction drawings or as necessary to complete the well.
- B. All well screen fittings and packers shall be manufactured by the well screen manufacturer and shall be designed for use with the particular well screen selected.

# PART 3 EXECUTION

## 3.1 WELL SCREEN INSTALLATION

- A. Install the well screen assemblies and fittings in conformance with the well screen manufacturer's recommendations.

**PART4      PAYMENT**

4.1      WELL SCREEN

- A.      Payment for providing and installing the well screen will be made at the unit price per linear foot installed as stated in the CONTRACTOR's Bid Schedules A, B, and C for WELL SCREEN ASSEMBLY.

4.2      BLANK CASING

- A.      Payment for providing and installing the blank casing will be made at the unit price per foot installed as stated in the CONTRACTOR's Bid Schedules A, B, and C for CASING.

4.3      FITTINGS AND CENTERING GUIDES

- A.      Full payment for providing and installing the well screen fittings and centering guides will be included in the unit price(s) for well screen as stated in the CONTRACTOR's Bid Schedules A, B, and C for WELL SCREEN ASSEMBLY.

**END OF SECTION**

## SECTION 00006 - GRAVEL PACK

### PART 1 GENERAL

#### 1.1 WORK INCLUDES

- A. This section covers the work, materials, and equipment necessary for furnishing and installing the filter pack at each of the wells within the CITY.

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. Provide all gravel, and other filter pack materials, and the materials and equipment necessary for placing the filter pack as specified for the well.

#### 2.2 FILTER MEDIA

- A. Gravel-pack filter media shall be thoroughly washed, sound, smooth uniform, durable, well-rounded glass or siliceous material containing, when delivered, less than 2 percent silt and clay, and no organic material, anhydrite, gypsum, mica, or calcareous material. For gravel filter pack, Specific gravity shall be not less than 2.25 grams per cubic centimeter or less. No calcium carbonate material will be acceptable. The filter media shall not contain more than 2 percent, by weight, of thin, flat, elongated pieces (pieces in which the largest dimension exceeds three times the smallest dimension) determined by hand-packing. Glass beads filter pack materials shall be clean and contain less than 0.5 percent material other than glass beads.
- B. The type, size, and gradation of the filter packing material shall meet the specifications in Table 5 – Filter Pack Specifications. A sand plug is to be placed on top of the filter pack prior to grouting. The sand plug material shall meet the specifications in Table 5 – Filter Pack Specifications. Final selection of the filter pack gradation will be made by the ENGINEER and be based on sieve analysis of formation samples, if applicable.

|                        |                    |                      |
|------------------------|--------------------|----------------------|
| <b>Transition Sand</b> | <b>Type (-)</b>    | Colorado Silica Sand |
|                        | <b>Mesh Size</b>   | #60                  |
|                        | <b>Length (ft)</b> | <b>10</b>            |
| <b>Gravel Pack</b>     | <b>Type (-)</b>    | 8/12 Gravel          |
|                        | <b>Size (mm)</b>   | 1.7 to 2.36          |
|                        | <b>Length (ft)</b> | <b>400</b>           |

- C. Submit to the ENGINEER a 5-pound sample of the proposed filter pack material for approval prior to delivery of filter pack to the site.

### 2.3 GRAVEL SOUNDING DEVICE

- A. Provide a measuring device to sound the gravel level in the holes during placement to detect bridging.

## PART 3 EXECUTION

### 3.1 GENERAL

- A. If high viscosity drilling fluid has been used in drilling, it shall be thinned with water, prior to placement of gravel.

### 3.2 PLACING FILTER MEDIA

- A. The filter media shall be introduced at a metered uniform rate in a manner that will allow even placement of the gravel. Filter pack shall be placed by tremie or equivalent method to ensure placement of the filter pack continuously from the bottom of the wells to a point above the well screen without separation or bridging of the materials as they are introduced into the wells. During placement of the filter media, the top of the filter media shall be continuously sounded to measure its rate of rise and to determine if bridging is occurring.
- B. Filter pack media shall be placed to completely fill the annulus in the specified interval. During the time of placement, fluid circulation shall be maintained through an ENGINEER approved swab block located approximately 40 feet below the fill depth of the filter pack sand. The diameter of the swab block shall not be more than 1/4-inch greater or 1/8-inch less than the casing I.D. The swab block shall be periodically reciprocated to remove fine-grained material, prevent bridging, and aid in

settling the filter pack media in the annulus of the borehole. Drilling fluid shall be maintained throughout the full depth of the well to the land surface and the well casing and screen shall be maintained in tension, until the filter material placement has been completed to the specified level. Care shall be taken to avoid bridging during installation of the sand.

- C. The filter pack shall be installed 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 filter pack placement. The level of the filter pack shall be measured periodically during placement with a wireline sounder, as required by the ENGINEER. Placement of the filter pack will be continuous, except when additional precautions are necessary to prevent bridging, or measurements of the filter pack level are being conducted.
- D. The quantity of filter pack material placed in the annulus shall not be less than that of the computed volume. Upon completion of the filter pack placement, excess filter pack material will be judged an indication of voids in the sand envelope and corrective measures shall be undertaken at the CONTRACTOR'S expense. The specific method of filter pack placement and the filter pack material must be approved by the ENGINEER (included in list of submittals).
- E. In accordance with applicable provisions of the AWWA A100 for water wells, before the introduction of filter pack into the well annulus, the drilling fluid shall be reconditioned until the follow properties are achieved:
- Weight- no greater than 9.1lb/gal (68 lb./ cu. feet);
  - Viscosity- no greater than 30 seconds per quart; and
  - Sand content- no greater than 1 percent volume.
- F. At the discretion of the ENGINEER, 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 site-specific circumstances. The CONTRACTOR shall adhere to the standards listed above, unless otherwise approved by the ENGINEER.
- G. If water is used to aid in the placement of the gravel, a 50 parts per million or greater concentration of chlorine (sodium hypochlorite or similar) must be maintained in the water. Calcium hypochlorite and or equivalent will not be allowed as an alternative to sodium hypochlorite

(especially if partially hydrolyzed polyacrylamide (PHPA) polymers such as Bariod's EZ Mud were used during the drilling of the pilot and reamed borehole. The specific sodium hypochlorite concentration and installation method must be approved by the ENGINEER and as submitted.

## **PART 4      PAYMENT**

### **4.1      GENERAL**

- A. Installed filter pack will be measured in linear feet to the nearest foot.
  
- B. Payment for all work, materials, and equipment specified in this section will be made at the unit price per foot installed as stated in the CONTRACTOR's Bid Schedules A for GRAVEL PACK (measured in tons) or SIGMUND LINDNER GLASS BEAD FILTER PACK (measured in metric tons).

**END OF SECTION**

## SECTION 00007 - GROUT SEAL

### PART 1 GENERAL

#### 1.1 WORK INCLUDES

- A. This section covers the work, materials, and equipment necessary for furnishing and installing the grout seal at each well.
- B. A cement bond log and caliper log after well completion as in Section 00003 – Geophysical Logging.

#### 1.2 REFERENCE STANDARDS

- A. American Society for Testing and Materials:
  - 1. ASTM C150-92 Type II, Portland Cement
  - 2. ASTM C494-92, Chemical Admixture for Concrete
  - 3. ASTM C618, Cement Grout with Fly Ash Additive

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. Provide all grout and the materials and equipment necessary for placement of the grout as specified in Table 6 – Grout Seal Specifications.
- B. Grouting services will be provided by a cement mixing and delivery company like Basic Energy Services or similar. The grout seal interval shall consist of an initial placement of quick curing cement (“Hot Plug”) immediately above the transition sand interval as in Section 00006 – Gravel Pack, then the remaining grout seal to surface will consist of a slower curing grout (“Standard Grout”) or as directed by the ENGINEER. Examples of acceptable “Hot Plug” and “Standard Grout” can be referenced in Schedules D and E.
- C. Grout placement will be done so as to seal the aquitard and aquifer units as best as possible where directed by the ENGINEER. The cement bond logging should show that the Primary Compression Wave (PCW) has a low amplitude, suggesting that the annular material is firmly bonded to the steel in grouted intervals.



| <b>Grout<br/>(Surface Casing)</b> | <b>Type (-)</b> | Neat Cement Grout  |
|-----------------------------------|-----------------|--------------------|
|                                   |                 | <b>Length (ft)</b> |
| <b>Grout<br/>(Blank Casing)</b>   | <b>Type (-)</b> | Neat Cement Grout  |
|                                   |                 | <b>Length (ft)</b> |

## 2.2 PORTLAND CEMENT

- A. Conforms to ASTM C150, Type I or III

## PART 3 EXECUTION

### 3.1 NEAT CEMENT GROUT

- A. Portion 1 cubic foot of cement to not more than 5.2 to 6 gallons of water per 94-pound sack of Portland cement. The cement grout slurry shall not exceed 15.6 lb./gal (117 lb/cf).

### 3.2 ADDITIVES

- A. The use of special cements or bentonite to reduce shrinkage or other admixtures (ASTM C494 or C618) to reduce permeability, increase fluidity and/or control set time, and the composition of the resultant slurry shall be reviewed by the ENGINEER.
- B. Consistency and method of mixing shall be reviewed by the ENGINEER prior to grouting.

### 3.3 PLACING

- A. The method of grout placement shall be reviewed by the ENGINEER. If grouting below the water table, no method will be permitted that does not force grout from the bottom of the space to be grouted to the surface. The grouting shall be done continuously and in such a manner as will ensure the entire filling of the annular space in one operation. No drilling operations will be permitted until the grout has cured. Curing time for Portland cement, Type I, is a

minimum of 72 hours and for Type III, a minimum of 36 hours.

## **PART 4 PAYMENT**

### **4.1 GENERAL**

- A. Installed grout seal will be measured in linear feet to the nearest foot.
- B. Payment for all work, materials, and equipment specified in this section will be made at the unit price per foot installed as stated in the CONTRACTOR's Bid Schedule A for GROUT SEAL.

**END OF SECTION**

## SECTION 00008 - WELL DEVELOPMENT

### PART 1 GENERAL

#### 1.1 WORK INCLUDES

- A. This section covers the work, materials, and equipment necessary for the development of at each of the CITY wells.
- B. The total development time is estimated on Table 7 – Well Development Specifications for each well. However, the ENGINEER shall be the sole judge as to when development is complete and may therefore increase or decrease the total development time at each well.

| <b>Table 7: Well Development Specifications</b>                        |  |  |                                      |
|--|--|--|--------------------------------------|
| <b>Development Method</b>  |  | <b>Specifications</b>                              | <b>PW-02</b>                         |
| <b>Phase 1:</b><br>Swabbing<br>(Sodium Hypochlorite)<br>and Airlifting | <b>Swabbing<br/>(Sodium Hypochlorite)</b><br><i>12 gal Sodium Hypochlorite<br/>(10%) per 1,000 gal Water</i> | Swab Rate (min/ft)                                 | 3                                    |
|  |  | Swab Direction (-)                                 | Screened Interval<br>(Top to Bottom) |
|  |  | Total Swab Duration (hr)                           | 20                                   |
|  |  | Set Time (hr)                                      | 24                                   |
|  |  | Total Chemical Contact Time (hr)                   | 44                                   |
|  | Airlifting   | Airlift Time (hr)                                  | 12                                   |
| <b>Phase 2:</b><br>Jetting (NW-220) and<br>Airlifting                  | <b>Jetting (NuWell-220)</b><br><i>3 gal NW-220 per<br/>1,000 gal Water</i>                                   | Jetting Rate (min/ft)                              | 3                                    |
|  |  | Jetting Direction (-)                              | Screened Interval<br>(Top to Bottom) |
|  |  | Total Jetting Duration (hr)                        | 20                                   |
|  |  | Set Time (hr)                                      | 8                                    |
|  |  | Total Chemical Contact Time (hr)                   | 28                                   |
|  | Airlifting   | Airlift Time (hr)                                  | 24                                   |
| <i>Optional</i>  |  | Pump and Surge (hr)                                | -                                    |
|  |  | <b>Total Development Time (hr)</b>                 | 108                                  |
|  |  | <b>Total Development, Excluding Set Times (hr)</b> | 76                                   |
|  |  | <b>Development Limit, Excluding Set Times (hr)</b> | 51 to 82                             |

### PART 2 PRODUCTS

#### 2.1 SWABBING EQUIPMENT

- A. Furnish all necessary compressors, piping, tools, pumps, and any other equipment to develop the wells by swabbing. The diameter of the swab apparatus shall not be more a 1/4-inch greater or 1/8-inch less than the casing I.D. The upper and lower swabbing rubbers should be placed no more than 10 feet apart and either open-ended or capped, approved by the ENGINEER.

## 2.2 AIRLIFT EQUIPMENT

- A. Furnish all necessary compressors, piping, tools, pumps, and any other equipment to develop the wells by airlifting with eductor methods to obtain an airlift flow rate of up to 300-400 gallons per minute.

## 2.3 JETTING EQUIPMENT

- A. Furnish all necessary compressors, piping, tools, pumps, and any other equipment to develop wells by jetting, and jetting the screened section at a rate defined in Table 7 – Well Development Specifications.

## 2.4 PUMPING AND SURGING EQUIPMENT

- A. Furnish a solid type surge block, bailer, sand pump, and all necessary appurtenant equipment necessary for developing the wells.

## 2.5 SAND CONTENT MEASURING DEVICE

- A. Provide a sand content measuring device such as a Rossum centrifugal sand separator, Imhoff Cone, or equal.

# **PART 3 EXECUTION**

## 3.1 DEVELOPMENT BY SWABBING AND AIRLIFTING

- A. After placement of the well casing, screens, gravel pack, sand plug, and grout, the wells will be developed by means of swabbing and airlifting. If fines or heavy sediments, which have been drawn into the wells, fills the tailpipe and/or any screened section, the wells should be bailed and/or cleaned by eductor (conventional airlifting) techniques from the bottom of the well before beginning swabbing. If this step is required, additional airlifting time will be added to the estimates on

Table 7 – Well Development Specifications.

- B. Well development should be accomplished by first swabbing the 12-inch inner diameter screened section at a rate and direction defined in Table 7 – Well Development Specifications. It is the sole responsibility of the CONTRACTOR to develop the well in accordance with this section without damage to the well screen or casing. The swabbing tool used for well development must be approved by the ENGINEER.
- C. Chemical treatments should be pumped via a 1-inch diameter airline assembled within the swabbing tool. The ENGINEER should provide volume calculations to the CONTRACTOR and ensure chemicals are emplaced at target elevations. All development chemicals must be ANSI/NSF 60 certified and PFAS-free. The CONTRACTOR must provide the ENGINEER with an SDS for all chemical additives used for well development at least three days prior to use. Development water should be contained and/or disposed of by the CONTRACTOR. Re-use of discharge water will not be allowed.
- D. A sodium hypochlorite solution with a target chlorine concentration of 1,200 mg/l should be placed in the screened sections of the well. Based on the available 10% or 12.5% sodium hypochlorite, the concentrated sodium hypochlorite should be mixed with a volume of portable water, prior to introduction into the well, as defined below:
- 12.5% sodium hypochlorite (9.6 gallons per 1,000 gallons of water)
  - 10% sodium hypochlorite (12 gallons per 1,000 gallons of water)
    - i. Chemical volumes should be calculated assuming mixing tank storage volume and borehole fluid volume within the screened interval. The concentration (mixing ratio in the tank) will change based on the borehole volume.

The contact time of the sodium hypochlorite concentration in the well should be at a minimum of 24 hours and should not exceed 48 hours.

- E. After swabbing while emplacing sodium hypochlorite, the solution will be kept in the well for a duration defined in Table 7 – Well Development Specifications. After the sodium hypochlorite set time, the well should be subsequently airlifted.
- F. During swab and airlift development, a discharge rate of no less than 50

must be maintained (unless limited by aquifer characteristics).

- G. Swab and airlift development should continue until it is determined by the ENGINEER that all visible particulate matter has been removed, determined from a grab sample of the developed water.

### 3.2 DEVELOPMENT BY JETTING AND AIRLIFTING

- A. After initial development by swabbing and airlifting, the wells will be developed by means of jetting. If fines, which have been drawn into the well, fill the tailpipe and/or any screened section, the wells shall be bailed and/or cleaned by eductor techniques to the bottom before resuming jetting.
- B. Jetting will be provided by a high pressure/low flow water nozzle assembly with an operating pressure that does not exceed 1,000 psi. Jetting apparatus will be pulled through the well screen via force of water jets.
- C. A non-phosphoric dispersant (e.g., NuWell-220) approved by the ENGINEER will be added to the jetting fluid to assist in removing drilling mud from the borehole wall and formation. The target solution of chemicals emplaced by jetting should be equivalent to 3 gallons of NuWell-220 per 1,000 gallons of portable water, mixed prior to the introduction to the well.

Other similar chemical additives may be used only if pre-approved by the ENGINEER. The specific type and placement method of any chemical additives must be approved by the ENGINEER. The dispersant will be distributed across the screened section via the jetting. The jetting rate and direction can be seen in Table 7 – Well Development Specifications.

- D. After jetting with NW-220, the solution will be kept in the well for a duration defined in Table 7 – Well Development Specifications. After the NW-220 set time, the well should be subsequently airlifted.

### 3.3 DEVELOPMENT BY PUMPING AND SURGING

- A. If after a well has been developed by swabbing, airlifting, and jetting, the ENGINEER determines if additional development is required, which will continue by means of pump and surge. If fines, which have been drawn into the well fill the well screen sump or tailpipe, the well shall be bailed or otherwise cleaned to the bottom before resuming surging. If determined to be required by the ENGINEER, pump and surge development is estimated to have a 12-hour duration with pumping rates ranging from 800 to 2,500 gpm.

### 3.3 DISPOSAL OF WATER

- A. Disposal of initial development water containing a heavy sediments water shall be the responsibility of the CONTRACTOR according to the price specified in the Bid Sheet. CONTRACTOR will be responsible for obtaining a Colorado Department of Public Health and Environment discharge permit, if required. Disposal of discharge water to the CITY's sanitary sewer may be allowed at the sole discretion of the ENGINEER. CONTRACTOR will seek ENGINEER'S approval prior to disposing of any development water to the sanitary sewer.

## PART 4 PAYMENT

### 4.1 HOURLY DEVELOPMENT

- A. Payment for the development of the well, regardless of the method(s) used, will be made at the unit price per hour as stated in the CONTRACTOR's Bid Schedule A for WELL DEVELOPMENT. The CONTRACTOR will not be paid the hourly rate for development during the time the equipment is not actually in use in the development of the wells, or for any equipment repair, or for any time, in the opinion of the ENGINEER, that the development procedure is not being accomplished in accordance with these Specifications. Payment at the hourly rate shall constitute full compensation for all work, materials, and equipment specified in this section. If ENGINEER or OWNER determines that additional development is required beyond the specified duration, the hourly rate will apply to additional development hours.

**END OF SECTION**

## SECTION 00009 - WELL AQUIFER TEST

### PART 1 GENERAL

#### 1.1 SITE CONDITIONS

- A. Environmental Requirements: Dispose of water produced during pumping tests in an environmentally sound manner in accordance with applicable Temporary Erosion and Sediment Control permit conditions or other federal, state, and local regulations. Water leaving the well site must be directed so as not to cause flooding or erosion. CONTRACTOR will be responsible for obtaining a Colorado Department of Public Health and Environment discharge permit, if required. Disposal of pumping test discharge water to the CITY's sanitary sewer may be allowed at the sole discretion of the ENGINEER. CONTRACTOR will seek ENGINEER'S approval prior to disposing of any pumping test discharge water to the sanitary sewer.

### PART 2 EXECUTION

#### 2.1 TESTS REQUIRED

- A. Provide work, materials, and equipment for conducting pumping tests at the CITY well site.
- C. Tests shall establish the hydraulic characteristics of the wells and aquifers.

#### 2.2 TEST PUMPS AND DRIVERS

- A. The test pump and driver will be selected by the contractor to meet the pumping requirements outlined in Table 8 – Aquifer Testing Specifications. CONTRACTOR must make arrangements for obtaining electric power at the test site.

#### 2.3 FLOW MEASUREMENT AND CONTROL AT EACH WELL

- A. Flowmeter: Magnetic induction flowmeter (with 4-20 milliamp signal output) and machined circular orifice weir and piezometer capable of measuring the pump discharge rate within plus or minus 5 percent of the true flow rate. The flow meter will also display a totalized flow value. A fully functioning backup magnetic induction meter shall be available onsite in the event



that the first does not function properly.

- B. Control Valve: Capable of adjusting the flow rate between the rates specified in Table 8.
- C. Water Level Measurement: Continuous data logging system such as manufactured by In-Situ, Dynotek or equal and meets the requirements outlined in Table 8 – Aquifer Testing Specifications.
- D. Sand Content Measurement: A Rossum sand content testing apparatus (in accordance to American Water Works Association A-100) shall be used to measure sand content during all pumping tests.

| <b>Table 8: Aquifer Testing Specifications</b> |   |
|--|---|
|  | <b>PW-02</b>  |
| <b>Pump Type (-)</b>                           | Submersible, complete with required column, discharge head and fittings |
| <b>Target Pumping Rate (gpm)</b>               | 1500  |
| <b>Static Water Level (ft)</b>                 | 100   |
| <b>Pump Depth (ft)</b>                         | 880   |
| <b>Estimated Pumping Water Level (ft)</b>      | 300   |
| <b>Estimated Design Dynamic Head (ft)</b>      | 350   |
| <b>Test Duration (hr)</b>                      | 72  |
| <b>Control Valve Range Limits (gpm)</b>        | 700-2000  |
| <b>Water Level Measurement Instrument (-)</b>  | Pressure Transducer and Airline   |
| <b>a. Transducer Pressure Rating (psi)</b>     | 500   |
| <b>b. Cable Length (ft)</b>                    | 900   |
| <b>Discharge Line Distance (ft)</b>            | Up to 200 feet  |

## 2.4 PREPARATION

- A. Access and Safety: Verify that access to the site is adequate and that equipment can be safely set up and operated at the site.
- B. Verify that provisions for water, electric power, and other utilities available at the site are adequate for execution of the Work.

## 2.5 INSTALLATION AT THE WELL SITE

- A. Pump and Driver: Set up pump with water inlet at the elevation specified in Table 8 – Aquifer Testing Specifications.

- B. Access Tube: Install a minimum 1.25-inch access tube to a depth approximately 5 feet above the pump assembly, and secure at the surface at the well site.
- C. Flow Control Valve: Install control valve on the discharge side of the pump, and at least 3 feet downstream of the flowmeter.
- D. Flow Measurement Equipment: Install level, and at least 3 feet downstream from any fitting or bend or as specified by the equipment manufacturer.
- E. Sand Measurement Equipment: Install and operate in accordance with manufacturers' recommendations.
- F. Discharge Piping: Install and maintain discharge piping of sufficient length, size, and strength to conduct pumped water to the distance specified in Table 8 – Aquifer Testing Specifications to an adjacent drainage path or as directed by the Grading, Erosion, Control, and Sedimentation permit or Colorado Department of Public Health and Environment discharge permit.
  - 1. Discharge the water so as to minimize washouts and creation of turbidity and to avoid damage to existing structures and other portions of the work.
  - 2. Construct temporary discharge baffles or spreading plates as required to safely discharge the water on the ground surface.
  - 3. Discharge piping should be equipped with at least one sample port capable of providing representative water quality samples for water quality testing.

## 2.6 OPERATIONS AT EACH WELL SITE

- A. Preliminary Test: Prior to beginning the pumping test at the well site, conduct a preliminary test of approximately 15-minute duration to confirm correct operation of the pump, flowmeter operation, and proper flow control valve setting. Allow well to recover for a period of 1 hour before starting the pumping test.
- B. Step Test: A Step Test will be conducted prior to the Constant Rate Test at the well site. The Step Test will consist of pumping the well for a set duration at different rates, as directed by the ENGINEER. Each step pumping rate shall be maintained for a minimum of 2 hours unless otherwise directed by the ENGINEER. At the end of the step test at the well site, allow the well to remain undisturbed for a minimum of 16 hours or until the water level returns to within one foot

of the pre-test static water level.

- C. Constant Rate Test: At the well site, start the test pump at the precise time specified by the ENGINEER.
  - 1. Adjust the pumping rate to the rate specified by the ENGINEER.
  - 2. Maintain the pumping rate continuously for the duration specified in Table 8 – Aquifer Testing Specifications, unless otherwise directed by the ENGINEER.
  - 3. At the end of the test, allow the well to remain undisturbed for a period equal to the pumping test duration before removing the pump or proceeding with other tests.

## 2.7 MEASUREMENTS AT EACH WELLSITE

- A. Records: Make accurate written records of water levels, pumping rates, time intervals, and other pertinent details of the pumping tests.
- B. Pumping Rates: Record pumping rate every 5 minutes for the first 2 hours of each test, every ½-hour for the next 4 hours of the test, and hourly thereafter, for the duration of the test.
- C. Background Water Levels: Measure and record the static water level in the well at 1/2-hour intervals for a period of 2 hours immediately preceding the start of a test.
- D. Drawdown Measurements: Measure the drawdown in the pumped well in accordance with the following schedule:
  - 1. Every 1 minute for the first 15 mins;
  - 2. Every 5 minutes for the 15 mins through 60 minute time period;
  - 3. Every half hour for 60 minutes through 120 minutes;
  - 4. Every hour for the remaining duration of the test.
- E. Recovery Measurements: Measure the recovery of the water level in the pumped well for a period equal to the duration of the pumping test, following the same measurement schedule used for drawdown measurements.

## 2.8 FIELD QUALITY CONTROL

- A. Sand Measurement: Measure and record the rate of sand production 1, 5, 10, 20, 30 minutes after the start of the test, and hourly thereafter for each well.
- B. Operators: Provide operators at the site throughout the tests to continuously monitor and operate test equipment and regulate

pumping rates.

**PART 3      PAYMENT**

**3.1      GENERAL**

- A. Payment for furnishing, installing, and removing the test pump, conducting flow sand content and water level measurements, and operating all test equipment will be included as a part of the time and materials bid amount stated in the CONTRACTOR's Bid Schedules A for WELL PUMPING TEST. If any testing is disrupted due to equipment failure, neglect, labor problems, and similar items before the pumping test is determined by the ENGINEER to be complete, it shall be the CONTRACTOR's responsibility to restart all disrupted tests and to complete in full the items as described under this Section (WELL PUMPING TEST).

**END OF SECTION**

## SECTION 00010 - WELL VIDEO INSPECTION

### PART I GENERAL

#### 1.1 GENERAL

- A. Prior to the final acceptance of the wells by the OWNER, the CONTRACTOR shall perform a color video survey of each of the wells. The purpose of the surveys is to provide the OWNER with "as-built" documentation and verify locations of the well casing and screen sections, and to provide baseline data for future inspections of the wells. It shall be the CONTRACTOR's responsibility to schedule each video survey at such a time, or prepare the wells in such a way, as to ensure that the wells are clear so that the casings and screens are readily visible.
- B. The CONTRACTOR or subcontractor used for this video survey work shall be a Colorado Licensed Pump Contractor or Well Driller, as required by the State Board of Examiners of Water Well and Pump Installation Contractors.

#### 1.2 SUBMITTALS

- A. Administrative Submittals: Schedule three (3) days prior to performing inspections.
- B. Quality Control Submittals: Provide ENGINEER with one copy of the written video log and electronic copy of the video survey before leaving each site.

### PART 2 PRODUCTS

#### 2.1 DIGITAL VIDEO

- A. Format: USB drive, email, or digital file share point.

### PART 3 EXECUTION

#### 3.1 EQUIPMENT

- A. The video logging unit shall be self-contained. A color video camera shall be sized to enter the casing and screen sections used in the completion of the wells, without risk to the wells or the camera. The supporting camera cable shall be of sufficient length and strength to view the entire completed well depth. The video logging truck shall be equipped with an on-board video monitor to allow viewing of the casing and screens during the real time inspection.

- B. The video survey unit shall simultaneously transpose the OWNER's name, well name, well permit number, footage, and the date of the inspection on the monitor screen and permanently on the video log. A footage counter/recorder shall read in feet and be accurate within 2 percent of the actual footage.
- C. The video survey camera shall be capable of full a full 360 view and a forward-facing view and record both views simultaneously. At the direction of the ENGINEER, the CONTRACTOR must be able to provide right angle viewing to view any casing or screen section in a direct elevation view. Additional right angle survey footage or multiple passes with the normal lens shall be made at the unit per foot price as stated in the CONTRACTOR's Proposal for WELL VIDEO INSPECTION.

### 3.2 PREPARATION

- A. Notify the ENGINEER at least two (2) days prior to the start of a video inspection and taping at each well. Clean and sterilize the equipment and support system with chlorine solution before lowering equipment into any well.

### 3.3 INSPECTION AND TAPING

- A. Perform inspections and tapings only while water is clear.
- B. During inspections maintain a continuous image on the video monitor and continuously record the image.
- C. During inspection, display numbers indicating depth of camera below the top of casing on the video monitor. Record numbers with the image on video delivery.
- D. At no time shall the well be left uncovered while the well is unattended. Upon completion of the video survey, the CONTRACTOR shall reinstall a watertight cap on the well.

### 3.4 POST-VIDEO DINFECTON

- A. Disinfect well after video is complete according to Colorado Water Well Construction RULES Rule 15.

## PART 4 PAYMENT

4.1 GENERAL

- A. Payment for all work, materials, and equipment specified in this section for a single pass video survey will be made at the unit per foot price as stated in each of the CONTRACTOR's Bid Schedules A for WELL VIDEO INSPECTION.
  
- B. Payment for all work, materials, and equipment specified in this section for additional video surveys will be made at the unit per foot price as stated in each of the CONTRACTOR's Bid Schedules A for WELL VIDEO INSPECTION.

**END OF SECTION**

**SECTION 00011 - DISINFECTION****PART 1 GENERAL**

## 1.1 WORK INCLUDES

- A. This section covers the work, materials, and equipment necessary for disinfecting the CITY wells.

**PART 2 PRODUCTS**

## 2.1 GENERAL

- A. Provide all materials and equipment necessary for disinfecting the wells as specified.

## 2.2 CHLORINE

- A. The chlorine solution (sodium hypochlorite) used for disinfecting the wells shall be of such volume and strength and shall be so applied that a concentration of at least 100 ppm of free available chlorine shall be obtained in all parts of the wells. Calcium hypochlorite and or equivalent will not be allowed as an alternative to sodium hypochlorite (especially if partially hydrolyzed polyacrylamide (PHPA) polymers such as Bariod's EZ Mud were used during the drilling of the pilot and reamed borehole).

**PART 3 EXECUTION**

## 3.1 DISINFECTION

- A. After a well has been completed and tested, it shall be thoroughly cleaned of all foreign substances. The inner linings of the wells shall be thoroughly cleaned to remove oil, grease, or other extraneous matter.
- B. The wells shall then be disinfected with the chlorine solution as specified. Chlorine solution shall be prepared and applied in accordance with the manufacturer's directions. The chlorine solution shall be poured into the wells and each well surged for 5 minutes. After 4 hours the wells shall be pumped or bailed until the chlorine concentration is less than 5 ppm.

**PART 4 PAYMENT**

## 4.1 GENERAL

- A. Payment for all work, materials, and equipment specified in this



section will be made at the lump sum price as stated in the CONTRACTOR's Bid Schedules A for DISINFECTION.

**END OF SECTION**

## SECTION 00012 TEMPORARY WELLHEAD COMPLETION

### PART 1 GENERAL

#### 1.1 WORK INCLUDES

- A. This section covers the work, materials, and equipment necessary for installing the current pump equipment and wellhead completions at the City of Alamosa (OWNER or CITY) well site.

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. Provide all materials and equipment necessary for installing the wellheads as specified.

#### 2.2 PROTECTIVE COVER

- A. The protective covers shall be shop fabricated to conform with these specifications.
- B. Provide a minimum 1/4-inch thick steel plate that is of the same composition of the well casing. The covering plate will be secured to the top of the well with a water-tight welded seam.

### PART 3 EXECUTION

#### 3.1 GENERAL

- A. The wellhead shall be completed as specified.

#### 3.2 PROTECTIVE COVER

- A. Tack weld temporary capping plate to casings after the wells have been tested and disinfected.

### PART 4 PAYMENT

#### 4.1 GENERAL

- A. Payment for all work specified in this section, including all labor, materials, equipment, etc., to provide and construct the temporary wellheads as specified will be made at the unit price stated in the CONTRACTOR's Bid Schedules A for TEMPORARY WELLHEAD COMPLETION.

**END OF SECTION**

## SECTION 00013 - GENERAL REQUIREMENTS FOR EQUIPMENT

### PART 1 GENERAL

#### 1.1 SCOPE OF WORK

- A. **SCOPE:** This section specifies general requirements that are applicable to all mechanical equipment specified within this Division. The Contractor is responsible for ensuring that all mechanical equipment meets the requirements of this section in addition to the specific requirements of the individual equipment specification section. Where the requirements of this section are in conflict with the requirements of an individual equipment specification section, the individual equipment specification shall take precedence.
- B. **EQUIPMENT LISTS:** Equipment lists, presented in these specifications and as specified on the drawings, are included for the convenience of the Contractor and are not complete listings of all equipment, devices and material to be provided under this contract. The Contractor agrees to prepare his own material and equipment takeoff lists as necessary to meet the requirements of this project manual.

#### 1.2 QUALITY ASSURANCE

- A. **ARRANGEMENT:** The arrangement of equipment shown on the drawings is based upon information available to the Owner at the time of design and is not intended to show exact dimensions peculiar to a specific manufacturer. The drawings are, in part, diagrammatic, and some features of the illustrated equipment installation may require revision to meet actual equipment installation requirements. Structural supports, foundations, connected piping, valves, and electrical conduit specified may have to be altered to accommodate the equipment provided. No additional payment will be made for such revisions and alterations.
- B. **REFERENCES:** This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

| Reference       | Title  |
|-----------------|--|
| AFBMA Std 9-90  | Load Ratings and Fatigue Life for Ball Bearings        |
| AFBMA Std 11-90 | Load Ratings and Fatigue Life for Roller Bearings      |
| ANSI B1.1-89    | Unified Screw Threads                                  |
| ANSI B1.20.1-83 | Pipe Threads, General Purpose (Inch)                   |
| ANSI B16.1-89   | Cast Iron Pipe Flanges and Flanged Fittings, Class 125 |

|                 |   |
|-----------------|---|
| ANSI B18.2.1-81 | and 250<br>Square and Hex Bolts and Screws, Including Askew<br>Head Bolts, Hex Cap Screws, and Log Screws |
| ANSI B18.2.2-87 | Square and Hex Nuts   |
| AWWA C110       | Ductile and Cast-Iron Fittings  |

- C. UNIT RESPONSIBILITY. Where specified in individual equipment specification sections, the Contractor shall assign unit responsibility to, and obtain each system from, the supplier of the primary or driven equipment. The supplier shall provide all components of the system to enhance compatibility, ease of construction and efficient maintenance. The responsible manufacturer shall coordinate selection and design of all system components such that all equipment is compatible and operates properly to achieve the performance requirements specified. Assignment of unit responsibility shall in no way relieve the Contractor of his responsibility to the Owner for performance of all systems as provided elsewhere in the Contract Documents.

### 1.3 SUBMITTALS

- A. Provide the following submittals, as applicable, for each unique equipment item and unique set of performance requirements in accordance with Section 00014. Items 1 through 9 listed below must be submitted, reviewed by the engineer, and accepted, prior to shipping of equipment (included in list of submittals).
1. Manufacturer's data including materials of construction, equipment configuration, details of installation, equipment weight, and UL certifications.
  2. Dimensioned fabrication drawings showing the entire assembly. This shall include a materials list, sizes, piping connections, ASTM designations and where appropriate, thicknesses, construction, and description of all major components.
  3. A copy of the contract document control diagrams and process and instrumentation diagrams, with addenda updates that apply to the equipment, marked to show specific changes necessary for the supplied equipment. If no changes are required, the drawing(s) shall be marked "no changes required."
  4. A copy of the individual equipment specification section with addenda updates that apply to the equipment specification section, with each paragraph check marked to show specification compliance or marked to show deviations.
  5. Electrical data and control and wiring diagrams.

6. Pump curves and data, marked to indicate the operating limits recommended for stable operation between which the equipment may be operated without surge, cavitation, or vibration.
7. Certified factory test data as specified where required in the individual equipment specification.
8. Warranty information as specified.
9. Provide motor data.
10. Provide equipment record.
11. Submit operation and maintenance manuals.
12. Proposed on-site testing and start-up procedures in step-by-step detail in accordance with Section 00014. Submittal of all test reports.
13. Provide installation certification form.

## **PART 2 PRODUCTS**

### **2.1 FLANGES AND PIPE THREADS**

- A. Flanges on equipment and appurtenances provided under this section shall conform in dimensions and drilling to ANSI/AWWA C110/A21.10, unless otherwise specified. Pipe threads shall conform in dimension and limits of size to ANSI B1.1, coarse thread series, Class 2 fit.
- B. Threaded flanges shall have a standard taper pipe thread conforming to ANSI B1.20.1. Unless otherwise specified, flanges shall be flat faced.
- C. Flange assembly bolts shall be heavy pattern, hexagonal head, carbon steel machine bolts with heavy pattern, hot pressed, hexagonal nuts conforming to ANSI B18.2.1 and B18.2.2. Threads shall be Unified Screw Threads, Standard Coarse Thread Series, Class 2A and 2B, ANSI B1.1.

### **2.2 BEARINGS**

- A. Unless otherwise specified, equipment bearings shall be oil or grease lubricated, ball or roller type, designed to withstand the stresses of the service specified. Each bearing shall be rated in accordance with the latest revisions of AFBMA Methods of Evaluating Load Ratings of Ball and Roller Bearings. Unless otherwise specified, equipment bearings shall have a minimum L-10 rating life of 50,000 hours. The rating life shall be determined using the maximum equipment operating speed.

- B. Grease lubricated bearings, except those specified to be factory sealed and lubricated, shall be fitted with easily accessible grease supply, flush, drain and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be standard hydraulic alumite type.
- C. Oil lubricated bearings shall be equipped with either a pressure lubricating system or a separate oil reservoir type system. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 60 degrees C and shall be equipped with a filler pipe and an external level indicator gage.
- D. All bearings accessible to touch and located within 7 feet measured vertically from floor or working level or within 15 inches measured horizontally from stairways, ramps, fixed ladders or other access structures shall either incorporate bearing housings with sufficient cooling to maintain surface temperature at 65 degrees C or less for continuous operation at bearing rated load and a 50 degrees C ambient temperature or appropriate shielding shall be provided that will prevent inadvertent human contact.

### 2.3 V-BELT ASSEMBLIES

- A. Unless otherwise specified, V-belt assemblies shall be Dodge Dyna-V belts with matching Dyna-V sheaves and Dodge Taper-lock bushings, Wood's Ultra V-belts with matching Ultra-V sheaves and Wood's Sure-Grip bushings, or equal.
- B. Sheaves and bushings shall be statically balanced. Additionally, sheaves and bushings which operate at a peripheral speed of more than 5500 feet per minute shall be dynamically balanced. Sheaves shall be separately mounted on their bushings by means of three pull-up grub or cap tightening screws. Bushings shall be key seated to the drive shaft.
- C. Belts shall be selected for not less than 150 percent of rated driver horsepower and, where two sheaves sizes are specified, shall be capable of operating with either set of sheaves. Belts shall be of the antistatic type where explosion proof equipment is specified.

### 2.4 PUMP SHAFT SEALS

- A. GENERAL: Seals for water and wastewater pump shafts shall be either stuffing box or mechanical seals. Unless specified otherwise, stuffing boxes and mechanical seals shall conform to the requirements set forth in this paragraph.
- B. MECHANICAL SEALS:
  - 1. Where mechanical seals are specified, the seal shall be of a nondestructive (nonfretting) type which requires no wearing sleeve for the shaft. Shafts for pumps specified with mechanical seals shall be furnished with no reduction in size through the seal area. Mechanical seals shall be

the cartridge type, requiring no field assembly, other than insertion into the pump. Metal parts shall be Type 316 or 316L stainless steel. Springs shall be Hastelloy C, or as specified. Rotary faces shall be tungsten carbide or silicon carbide. Stationary faces shall be ceramic, tungsten carbide, or silicon carbide.

2. Mechanical seals for overhung shaft, constant speed pumps and split case, centrifugal pumps shall be self-aligning split type, Chesterton 442M Split Seal, no substitutes.
3. Mechanical seals for variable speed, overhung shaft pumps shall be double, balanced, self-aligning type, Chesterton 442, no substitutes.
4. Boxes for mechanical seals on pumps for contaminated water service (sludge, grit, wastewater, scum, reclaimed water, etc.) shall be drilled and tapped for installation of clean water barrier fluid supply piping.

#### C. SHAFT PACKING:

1. Where shaft packing is specified, stuffing boxes shall be tapped to permit introduction of seal liquid and shall hold a minimum of five rows of packing. Stuffing boxes shall be face attached. Stuffing box and shaft shall be suitable for field installation, without machining or other modifications, of the mechanical seal specified in paragraph 11000-2.4.B for the applicable pump and operating conditions.
2. Unless otherwise specified, lantern rings shall be bronze or Teflon, packing shall be die-molded packing rings of non-asbestos material suitable for the intended service and as recommended by the manufacturer, and glands shall be bronze, two piece split construction. Lantern rings shall be of two-piece construction and shall be provided with tapped holes to facilitate removal. Lantern rings shall be drilled and tapped 1/4 NC-20. Threaded lantern ring removal tools shall be provided with spare parts for each pump.

#### D. SEAL WATER REGULATING AND MONITORING SYSTEM

1. Seal water monitoring system shall be a complete unified component capable of controlling all necessary aspects of the seal water system for pumps or equipment utilizing a packing gland type or double mechanical type shaft seal. Complete monitoring system shall include the single component control unit, mounting stand or bracket and associated hardware, and all necessary hoses, quick couplings, check valves, hose nipples, and hose couplings required for a complete and functioning system.
2. The base of the control unit shall be constructed of 7/8" thick 316 stainless



steel to accommodate fittings. Seal connections shall be 1/4" NPT for shaft sizes up to 2" diameter and pumped fluid temperature < 120 deg F. For shafts > 2" diameter or pumped fluid temperatures > 120 deg F, unit shall have min. 3/8" connections. Unit shall include a push button test and clean system for the flow meter which can be activated while unit is in operation. Unit shall utilize orifice shaped valves to allow larger particles of dirt and debris to pass through without stopping the flow or plugging the unit. Pressure gauge shall be glycerin filled.

3. Complete seal water monitoring system as specified shall be Safematic Safeunit Model SFP-08-10 or approved equal. Unit shall be provided with connections as follows:
  - a. Packing gland type seal water system  
Safematic Safeunit Model SFP  
1 connection – water supply to unit  
1 connection – water supply from unit to the shaft seal
  - b. Double mechanical type seal water system  
Safematic Safeunit Model SFD  
1 connection – water supply to unit  
1 connection – water supply from unit to shaft seal  
1 connection – water return from shaft seal to unit  
1 connection – drain line from unit

## 2.5 COUPLINGS

- A. Unless otherwise specified in the particular equipment sections, equipment with a driver greater than 1/2 HP, and where the input shaft of a driven unit is directly connected to the output shaft of the driver, shall have its two shafts connected by a flexible coupling which can accommodate angular misalignment, parallel misalignment and end float, and which cushions shock loads and dampens torsion vibrations. The flexible member shall consist of a tire with synthetic tension members bonded together in rubber. The flexible member shall be attached to flanges by means of clamping rings and cap screws, and the flanges shall be attached to the stub shaft by means of taperlock bushings which shall give the equivalent of a shrunk-on fit. There shall be no metal-to-metal contact between the driver and the driven unit. Each coupling shall be sized and provided as recommended by the coupling manufacturer for the specific application, considering horsepower, speed of rotation, and type of service.
- B. Where torque or horsepower capacities of couplings of the foregoing type is exceeded, Thomas-Rex, Falk Steel Flex, or equal, couplings will be acceptable provided they are sized in accordance with the equipment manufacturer's recommendations and sizing data are submitted. They shall be installed in conformance to the coupling manufacturer's instructions.

## 2.6 GUARDS

- A. Exposed moving parts shall be provided with guards which meet the requirements of OSHA. Guards shall be fabricated of 14-gage steel, 1/2-13-15 expanded metal screen to provide visual inspection of moving parts without removal of the guard. Guards shall be galvanized after fabrication and shall be designed to be readily removable to facilitate maintenance of moving parts. Reinforced holes shall be provided. Lube fittings shall be extended through guards.

## 2.7 CAUTION SIGNS

- A. Equipment with guarded moving parts, which operates automatically or by remote control shall be identified by signs reading "CAUTION - AUTOMATIC EQUIPMENT MAY START AT ANY TIME". Signs shall be installed near guarded moving parts. Refer to Section 00013.

## 2.8 GAGE TAPS, TEST PLUGS AND GAGES

- A. Gage taps shall be provided on the suction and discharge sides of pumps, blowers and compressors. Pressure and vacuum gages shall be provided where specified.

## 2.9 NAMEPLATES

- A. A manufacturer's nameplate shall be provided for each piece of equipment and shall identify the manufacturer's name and address, and the specific style and/or model of the equipment provided.
- B. Project identification nameplates shall be provided on each item of equipment and shall contain the specified equipment name or abbreviation and equipment number. Equipment nameplates shall be engraved or stamped stainless steel and fastened to the equipment in an accessible location with stainless steel screws or drive pins.
- C. Project identification nameplates for pumps shall indicate rated head and flow, pump operating speed (rpm), and impeller diameter.

## 2.10 LUBRICANTS

- A. The Contractor shall provide for each item of mechanical equipment a supply of the lubricant required for the commissioning period. Lubricants shall be of the type recommended by the equipment manufacturer and shall be products of the Owner's current lubricant supplier. The Contractor shall limit the various types of lubricants by consolidating them, with the equipment manufacturer's approval, into the least number of different types. Not less than 90 days before the date shown in his construction schedule for starting, testing and adjusting equipment, the Contractor shall provide the Owner with three copies of a list showing the required lubricants, after consolidation, for each item of mechanical equipment. The list shall show estimated quantity of lubricant needed for a full year's operation, assuming the equipment will be operating continuously.

- B. Lubricant which may be in contact with potable water must be NSF 61 approved.

#### 2.11 ANCHOR BOLTS

- A. Anchor bolts shall be designed for lateral forces for both pullout and shear. Anchor bolts shall be 304 Stainless Steel.

#### 2.12 SPARE PARTS

- A. Spare parts, wherever required by detailed specification sections, shall be stored in accordance with the provisions of this paragraph. Spare parts shall be tagged by project equipment number and identified as to part number, equipment manufacturer, and subassembly component (if appropriate). Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a suitable box, identified with stenciled lettering stating the name of the equipment, equipment numbers, and the words "spare parts." A neatly typed inventory of spare parts shall be taped to the exterior of the box.

### **PART 3 EXECUTION**

#### 3.1 GENERAL

- A. The manufacturer shall assume responsibility for packaging to prevent transit and handling damage.
- B. Install each specified equipment system, including accessories, where shown on the drawings, as specified herein, and as recommended by the equipment manufacturers written instructions. Bring any discrepancies immediately to the attention of the Engineer.

#### 3.2 INSTALLATION AND FIELD TESTING

- A. Provide factory certified service technician to inspect the installation, unless otherwise specified.
- B. All equipment shall be field tested after installation, in accordance with Section 00013, the Contract Documents, the requirements of this section, and the requirements of the individual equipment specification, to demonstrate satisfactory operation and performance, without causing excessive noise, cavitation, vibration, leakage, overheating, or other operational deficiencies. Field testing shall be performed under the supervision of an experienced field representative of the manufacturer, who shall supervise the testing and shall certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.
- C. Start-up. Start-up, check and operate equipment over the entire operational range and speed range.

- D. Pump systems. Pumps systems shall be tested for compliance with the following:
  - 1. Pump performance shall be documented by obtaining concurrent readings, showing motor voltage, amperage, pump suction head, and pump is charge head for at least 4 pumping conditions. Each power lead to the motor shall be checked for proper current balance. All instrumentation necessary to conduct the testing shall be provided by the Contractor.
- E. The installation and initial operation of all components shall be certified.

### 3.3 TRAINING

- A. Unless otherwise specified, training addressing the theory of operation, testing, troubleshooting, and maintenance of equipment item and system shall be provided. Training shall be conducted in accordance with Section 00021. Minimum training duration shall be as specified in the individual equipment specification.

**END OF  
SECTION**

## SECTION 00014 SUBMITTALS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Submittals covered by these requirements include manufacturer's information, shop drawings, test procedures, test results, samples, requests for substitutions, and miscellaneous work-related submittals. Submittals shall also include, but not be limited to, all mechanical, electrical and electronic equipment and systems, materials, reinforcing steel, fabricated items, and piping and conduit details. Furnish all drawings, specifications, descriptive data, certificates, samples, tests, methods, schedules, and manufacturer's installation and other instructions as specifically required in the contract documents to demonstrate fully that the materials and equipment to be furnished and the methods of work comply with the provisions and intent of the contract documents. Submittals are to include at a minimum the submittals outlined in Table 12.

#### 1.2 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal. Assure that the material, equipment or method of work shall be as described in the submittal. Verify that all features of all products conform to the specified requirements. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment, which are being submitted for review. Cross out or obliterate all extraneous materials or information.
- B. Coordinate submittals with the work so that work will not be delayed. Coordinate and schedule different categories of submittals so that one will not be delayed for lack of coordination with another. No extension of time will be allowed because of failure to properly schedule submittals.

#### 1.3 SUBMITTALS

- A. Except where specified, submit all shop drawing submittals as product data and information to the Owner for review.
- B. The CITY intends to make operational an on-line project management tool that will include submittals and shop drawings. The Contractor shall be required to use this tool effectively and correctly to upload submittals, review the submittals, and take appropriate action.
- C. Provide digital submittal documents directly to the ENGINEER for

review.

#### 1.4 TRANSMITTAL PROCEDURE

- A. Unless otherwise specified, submittals regarding material and equipment shall be accompanied by Transmittal Form 00018-A specified in this section. Use a separate form for each specific item, class of material, equipment, and items specified in separate, discrete sections, for which the submittal is required. Submittal documents common to more than one piece of equipment shall be identified with all the appropriate equipment numbers. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.
- B. Note a unique number, sequentially assigned, on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: "XXX"; where "XXX" is the sequential number assigned by the Contractor. Resubmittals shall have the following format: "XXX-Y"; where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 25B, for example, is the second resubmittal of submittal 25.
- C. If the Contractor proposes to provide material, equipment, or method of work which deviates from the project manual, indicate so under "deviations" on the transmittal form accompanying the submittal copies.
- D. Submittals that do not have all the information required to be submitted, including deviations, will not be accept and will be returned without review.

#### 1.5 REVIEW PROCEDURE

- A. Submittals are specified for those features and characteristics of materials, equipment, and methods of operation that can be selected based on the Contractor's judgment of conformance to the specified requirements. Other features and characteristics are specified in a manner that enables the Contractor to determine acceptable options without submittals. The review procedure is based on the Contractor's guarantee that all features and characteristics not requiring submittals conform as specified. Review shall not extend to means, methods, techniques, sequences or procedures of construction, or to verifying quantities, dimensions, weights or gages, or fabrication processes (except where specifically indicated or required by the project manual) or to safety precautions or programs incident thereto. Review of a

separate item, as such, will not indicate approval of the assembly in which the item functions.

- B. Unless otherwise specified, ENGINEER/OWNER will review the submittal within 10 calendar days after receipt and return the marked-up original. The returned submittal shall indicate one of the following actions:
1. If the review indicates that the material, equipment or work method complies with the project manual, submittal copies will be marked "NO EXCEPTIONS TAKEN." In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.
  2. If the review indicates limited corrections are required, copies will be marked "MAKE CORRECTIONS NOTED." The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in O&M data, a corrected copy shall be provided.
  3. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked "AMEND AND RESUBMIT." Except at his own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."
  4. If the review indicates that the material, equipment, or work method does not comply with the project manual, copies of the submittal will be marked "REJECTED - DEVELOP REPLACEMENT." Submittals with deviations that have not been identified clearly may be rejected. Except at his own risk, the Contractor shall not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

## 1.6 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

- A. Review of contract drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, shall not relieve the Contractor of the Contractor's responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the Engineer and the Owner, or by any officer or employee thereof, and the Contractor shall have no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed. A mark of "NO EXCEPTIONS TAKEN" or "MAKE

CORRECTIONS NOTED" shall mean that the Owner has no objection to the Contractor, upon the Contractor's responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

**END OF SECTION**



## SECTION 00015 - SHIPMENT, PROTECTION, AND STORAGE

### PART 1 GENERAL

#### 1.1 SCOPE

- A. Equipment, products and materials shall be shipped, handled, stored, and installed in ways which will prevent damage to the items. Damaged items will not be permitted as part of the work except in cases of minor damage that have been satisfactorily repaired and are acceptable to the Engineer.

#### 1.2 QUALITY ASSURANCE

- A. To the greatest extent possible, the Contractor shall provide products, materials, or equipment of a singular generic kind from a single source.
- B. Where more than one choice is available as options for selection of a product, material, or equipment, the Contractor shall select an option which is comparable with other products, materials, or equipment already selected and approved by the CITY/ENGINEER. Compatibility is a basic general requirement of product/material selections.

#### 1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Products shall be delivered, handled, and stored in accordance with manufacturer's written recommendations and by methods and means which will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize the long-term storage of products at site and the overcrowding of construction spaces.
- B. Contractor shall especially provide delivery/installation coordination to ensure minimum holding or storage time for products recognized as flammable, hazardous, fragile, having a short shelf life, or easily damaged due to deterioration, theft, and/or other source of loss.

#### 1.4 EQUIPMENT

- A. All equipment shall be protected against damage from moisture, dust, handling, or other cause during transport from manufacturer's premises to site. Each item or package shall be marked with the number unique to the specification reference covering the item.
- B. Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts of equipment shall be delivered in assembled or sub-assembled units where possible equipment or valve number designated

in this contract. Marker shall be of stainless steel or other suitable material to the Engineer's approval. Label location will be easily visible.

## 1.5 SHIPPING

- A. Bearing housings, vents and other types of openings shall be wrapped or otherwise sealed to prevent contamination by grit and dirt.
- B. Damage shall be corrected to conform to the requirements of the contract before the assembly is incorporated into the work. The Contractor shall bear the costs arising out of dismantling, inspection, repair and reassembly.

## 1.6 FACTORY-APPLIED COATINGS

- A. All coatings on all products and equipment shall be intact and free from blemishes and defects. Any blemished or defective coatings shall be repaired at the sole expense of the Contractor to the Engineer's approval and in conformance with the Contract Documents.

## 1.7 STORAGE

- A. During the interval between the delivery of equipment to the site and installation, all equipment, unless otherwise specified, shall be stored in an enclosed space affording protection from weather, dust and mechanical damage and providing favorable temperature, humidity and ventilation conditions to ensure against equipment deterioration. Manufacturer's recommendations shall be adhered to in addition to these requirements.
- B. Equipment and materials to be located outdoors may be stored outdoors if approved by the Engineer and if adequately protected against moisture, condensation, sun, temperature, theft, and other outdoor conditions. Equipment shall be stored at least 6 inches above ground. Temporary power shall be provided to energize space heaters or other heat sources for control of moisture condensation. Space heaters or other heat sources shall be energized without disturbing the sealed enclosure.

## 1.8 PROTECTION OF EQUIPMENT AFTER INSTALLATION

- A. After installation, all equipment shall be protected from damage from, including but not limited to, dust, abrasive particles, debris and dirt generated by the placement, chipping, sandblasting, cutting, finishing and grinding of new or existing concrete, terrazzo and metal; and from the fumes, particulate matter, and splatter from welding, brazing and

painting of new or existing piping and equipment. As a minimum, vacuum cleaning, blowers with filters, protective shieldings, and other dust suppression methods will be required at all times to adequately protect all equipment. During concreting, including finishing, all equipment that may be affected by cement dust must be completely covered. During painting operations, all grease fittings and similar openings shall be covered to prevent the entry of paint. Electrical switchgear, unit substation, and motor load centers shall not be installed until after all concrete work and sandblasting in those areas have been completed and accepted and the ventilation systems installed.

- B. PVC piping or materials which are to be submerged shall be installed no earlier than 30 days prior to being placed into service.

**END OF SECTION**

**SECTION 00016 - CONTRACT CLOSEOUT****PART 1 GENERAL****1.1 CLOSEOUT PROCEDURES**

- A. The following defines the Contractor and Owner project closeout procedures.
1. Contractor shall advise the Owner in writing that the Contractor has reached "Substantial Completion". Closeout may be conducted by areas or portions of the work if requested by the Owner.
  2. Owner inspects the work to determine if it is substantially complete, and issues a Certificate of Substantial Completion plus a "Punch List" of items to be completed or corrected.
  3. Contractor completes and corrects all punch list items and notifies the Owner in writing that the Work is ready for final inspection. At this time, a final application for payment is submitted.
  4. Owner makes final inspection. When the work is found to be acceptable under the Contract Documents, and the Contract fully performed, the Owner will publicly advertise release of final payment and issue a final Certificate for Payment within 30 days.

**1.2 FINAL PAPERWORK**

Prior to release of final payment, the Contractor shall deliver the following items to the Owner:

1. Warranties, Special Bonds, and Service Agreements
2. Receipts for Extra Materials Delivered to the Owner
3. Final Application for Payment
4. Consent of Surety to Final Payment
5. Project Record Documents
6. Record drawings as specified
7. Operating manuals and instructions
8. Maintenance stock items, spare parts and special tools as specified

**END OF SECTION**

## SECTION 00017 TRAINING

### PART 1 GENERAL

#### 1.1 SCOPE OF WORK

- A. This section contains requirements for training the Owner's personnel, by persons retained by the CONTRACTOR specifically for the purpose, in the proper operation and maintenance of the equipment and systems installed under this contract.

#### 1.2 SUBMITTALS

- A. The following information shall be submitted to the Engineer in accordance with the provisions of Section - 00014. The training material shall be reviewed and accepted by the Engineer not less than 3 weeks prior to the provision of training.
  - 1. Lessons plans for each training session to be conducted by the manufacturer's representatives. In addition, training manuals, handouts, visual aids, and other reference materials shall be included.
  - 1. Subject of each training session, identity and qualifications of individuals to be conducting the training, and tentative date and time of each training session.
  - 2. Video recording of training session, provided in electronic format within 3 weeks of the training completion.

#### 1.3 QUALITY ASSURANCE

- A. Where required by the detailed specifications, the Contractor shall provide on-the-job training of the Owner's personnel. The training sessions shall be conducted by qualified, experienced, factory-trained representatives of the various equipment manufacturers. Training shall include instruction in both operation and maintenance of the subject equipment.

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. Where specified, the Contractor shall conduct training sessions for the Owner's personnel to instruct the staff on the proper operation, care, and maintenance of the equipment and systems installed under this contract. Training shall take place at the site of the work and under the conditions specified in the following paragraphs. Approved operation and maintenance manuals shall be available at least 30 days prior to the

date scheduled for the individual training session.

## 2.2 LOCATION

- A. Training sessions shall take place at the site of the work.

## 2.3 AGENDA AND VIDEO

- A. A formal agenda shall be prepared for each training session. Agendas shall contain an outline of the material to be presented and a time allocation for each subject.
- B. Each specific training item shall be videoed when describing the operation and maintenance procedures and delivered to the OWNER. Each video shall be labeled with the piece of equipment and procedure recorded. One complete set of the agenda, training manuals, handouts, visual aids, and reference material shall be the property of the OWNER and shall be suitably bound for proper organization and easy reproduction. The CONTRACTOR shall furnish an electronic copy of the necessary agenda, training manuals, handouts, visual aids and reference materials to the ENGINEER at least 1 week prior to each training session.

## 2.4 FORMAT AND CONTENT

- A. Each training session shall be at the specific location of the subject equipment or system. As a minimum, training session shall cover the following subjects for each item of equipment or system:
  - 1. Familiarization
    - a. Review catalog, parts lists, drawings, etc., which have been previously provided.
    - b. Check out the installation of the specific equipment items.
    - c. Demonstrate the unit and indicate how all parts of the specifications are met.
    - d. Answer questions.
  - 2. Safety
    - a. Using material previously provided, review safety references. b. Discuss proper precautions around equipment.
  - 3. Operation

- a. Using material previously provided, review reference literature.
  - b. Explain all modes of operation (including emergency).
  - c. Check out Owner's personnel on proper use of the equipment.
4. Preventive Maintenance
- a. Using material previously provided, review preventive maintenance (PM) lists including:
    - 1) Reference material.
    - 2) Daily, weekly, monthly, quarterly, semiannual, and annual jobs.
  - b. Show how to perform PM jobs.
  - c. Show Owner's personnel what to look for as indicators of equipment problems.
5. Corrective Maintenance
- a. List possible problems.
  - b. Discuss repairs--point out special problems.
  - c. Open up equipment and demonstrate procedures, where practical.
6. Parts
- a. Show how to use previously provided parts list and order parts.
  - b. Check over spare parts on hand. Make recommendations regarding additional parts that should be available.
7. Local Representatives
- a. Where to order parts: Name, address, telephone.
  - b. Service problems:
    - 1) Who to call.
    - 2) How to get emergency help.
8. Operation and Maintenance Manuals
- a. Review any other material submitted.
  - b. Update material, as required.

## PART 3 EXECUTION

### 3.1 GENERAL

- A. Training shall be conducted in conjunction with the operational testing and commissioning periods. The Contractor shall coordinate the training day with the Owner, including providing the Owner a minimum of three weeks' notice in advance of the desired date. Training shall be certified on Form 11000-B specified in Section 01999.
- B. Acceptable operation and maintenance manuals for the specific equipment shall be provided to the Owner prior to the start of any training.
- C. The following services shall be provided for each item of equipment or system as required in individual specification sections. Additional services shall be provided, where specifically required in individual specification sections.
  - 1. At a minimum, classroom equipment training for operations personnel will include:
    - a. Using slides and drawings, discuss the equipment's specific location in the plant and an operational overview.
    - b. Purpose and function of the equipment.
    - c. A working knowledge of the operating theory of the equipment.
    - d. Startup, shutdown, normal operation, and emergency operating procedures, including a discussion on system integration and electrical interlocks, if any.
    - e. Identify and discuss safety items and procedures.
    - f. Routine preventative maintenance, including specific details on lubrication and maintenance of corrosion protection of the equipment and ancillary components.
    - g. Operator detection, without test instruments, of specific equipment trouble symptoms.
    - h. Required equipment exercise procedures and intervals.
      - 1) Routine disassembly and assembly of equipment if applicable (as judged by the Owner on a case-by-case basis) for purposes such as operator inspection of



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- equipment.
  - 2) Video recording and electronic video of classroom training.
2. As a minimum, hands-on equipment training for operations personnel will include:
- a. Identify location of equipment and review the purpose.
  - b. Identifying piping and flow options.
  - c. Identifying valves and their purpose.
  - d. Identifying instrumentation:
    - 1) Location of primary element.
    - 2) Location of instrument readout.
    - 3) Discuss purpose, basic operation, and information interpretation.
  - e. Discuss, demonstrate, and perform standard operating procedures and round checks.
  - f. Discuss and perform the preventative maintenance activities.
  - g. Discuss and perform startup and shutdown procedures.
  - h. Perform the required equipment exercise procedures.
  - i. Perform routine disassembly and assembly of equipment if applicable.
  - j. Identify and review safety items and perform safety procedures, if feasible.
3. Classroom equipment training for the maintenance and repair personnel will include:
- a. Theory of operation.
  - b. Description and function of equipment.
  - c. Startup and shutdown procedures.
  - d. Normal and major repair procedures.

- e. Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings.
  - f. Routine and long-term calibration procedures.
  - g. Safety procedures.
  - h. Preventative maintenance such as lubrication; normal maintenance such as belt, seal, and bearing replacement; and up to major repairs such as replacement of major equipment part(s) with the use of special tools, bridge cranes, welding jigs, etc.
4. Hands-on equipment training for maintenance and repair personnel shall include:
- a. Locate and identify equipment components.
  - b. Review the equipment function and theory of operation.
  - c. Review normal repair procedures.
  - d. Perform startup and shutdown procedures.
  - e. Review and perform the safety procedures.
  - f. Perform Owner approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.

**END OF SECTION**

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FIGURE

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