PART 1
GENERAL

7.1.1 Purpose

The purpose of this project is to destroy eight (8) existing monitoring wells, and to install thirteen (13) monitoring wells for the Soquel Creek Water District (District). Seven of the wells will be replacement wells for existing nested wells that are to be destroyed (SC-10RA and SC-10RAA, SC-11RA, SC-11RB and SC-11RC, and SC-18RA and SC-18RAA), and six will be new wells (SC-10AAA, SC-23A, SC-23B, SC-23C, SC-A9A and SC-A9B). One well (SC-11D) will be destroyed without replacement. Where more than one monitoring well is to be installed at a site, the wells will be constructed as clusters of either two or three monitoring wells in separate boreholes as part of Soquel Creek Water District’s monitoring well network. The following technical specifications establish minimum requirements that must be met in the destruction of eight (8) existing wells, and construction and development of thirteen (13) new monitoring wells.

7.1.2 Project Schedule

Five mobilizations shall occur in the following order:

1. Quail Run (SC-23)
2. Porter Gulch (SC-11)
3. Larkin Valley (SC-A9)
4. Cherryvale (SC-10)
5. Main Street (SC-18)

7.1.3 Project Location

The new wells will be located in five separate locations (Figure 1).
Figure 1: Project Location
Three new monitoring wells (SC-23A, SC-23B, and SC-23C) will be drilled and constructed on Quail Run Road near Hawk Peak Road in Aptos (Figure 2 and Figure 3). No existing wells will be destroyed at this location.

The existing SC-11 nested wells (Porter Gulch) comprise four multi-level monitoring wells completed within one large diameter borehole. All four of the nested wells are to be destroyed after three replacement clustered monitoring wells have been drilled and constructed. The existing wells to be destroyed are located on private property, and the new wells will either be located in the County right-of-way or on private property. The replacement wells will be located a minimum of 20 feet away from the destroyed wells. The well site is located on Porter Gulch Road in Soquel (Figure 4 and Figure 5).

Two new clustered monitoring wells (SC-A9A and SC-A9B) will be drilled and constructed at the Larkin Valley tank site in Soquel. No existing wells will be destroyed at this location (Figure 6 and Figure 7).

Two existing nested wells that comprise the SC-10 wells are to be destroyed after three clustered monitoring wells have been drilled and constructed. The well site is located on Cherryvale Avenue in Soquel (Figure 8 and Figure 9). The existing wells to be destroyed are located on Cherryvale Avenue in Soquel, and the new wells will be located in the County right-of-way alongside Cherryvale Ave. The replacement monitoring wells are to be located at a minimum distance of 20 feet away from the destroyed wells.

The two nested wells that comprise the SC-18 wells are to be destroyed after two clustered monitoring wells have been drilled and constructed. The well site is located on Main Street in Soquel (Figure 10 and Figure 11). The existing wells to be destroyed are located on District property, and the new wells will be located in the County right-of-way alongside Main Street. The replacement monitoring wells are to be located at a minimum distance of 20 feet away from the destroyed wells.

Streets and approximate coordinates for all five locations are summarized in Table 1.
Figure 2: General Location of SC-23 Site (Quail Run)
Figure 3: Location of SC-23A, B, and C (Quail Run) Monitoring Wells
Figure 4: General Location of SC-11 Site (Porter Gulch)
Figure 5: Location of SC-11RA, RB, and RC (Porter Gulch) Monitoring Wells
Figure 7: Location of SC-A9A and B (Larkin Valley)
Figure 8: General Location of SC-10 Site (Cherryvale)
Figure 10: General Location of SC-18 Site (Main Street)
Figure 11: Location of SC-18RA and RAA (Main Street)
Table 1: Summary of New Monitoring Well Locations

<table>
<thead>
<tr>
<th>Well Cluster</th>
<th>Location</th>
<th>Approximate Coordinates</th>
<th>Approximate Elevation, feet AMSL</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC-23 (A, B, C)</td>
<td>Quail Run Rd.</td>
<td>36.983, 121.895</td>
<td>218</td>
</tr>
<tr>
<td>SC-11 (RA, RB, RC)</td>
<td>Porter Gulch Rd.</td>
<td>37.012, 121.924</td>
<td>499</td>
</tr>
<tr>
<td>SC-A9 (A, B)</td>
<td>Larkin Valley Rd.</td>
<td>36.955, 121.850</td>
<td>400</td>
</tr>
<tr>
<td>SC-10 (RA, RAA, AAA)</td>
<td>Cherryvale Ave.</td>
<td>37.010, 121.950</td>
<td>86</td>
</tr>
<tr>
<td>SC-18 (RA, RAA)</td>
<td>N. Main St.</td>
<td>36.991, 121.955</td>
<td>54</td>
</tr>
</tbody>
</table>

Final locations will be determined in the field and approved by the District. Final well coordinates and elevations will be determined by a licensed surveyor contracted by the District after construction. Prior to bidding, Contractor shall inspect all five drilling sites and make provisions for the mobilization and demobilization of personnel, equipment and supplies, and material at each location.

7.1.4 Hours of Work

Normal work hours are between 7:00 am and 7:00 pm for contiguous days until appropriate stopping points, which will not adversely impact the integrity of the well. Non-working days shall not be weekdays except for holidays.

7.1.5 Utility Requirements

The District will mark the well locations and Contractor shall arrange for all drilling locations to be cleared by USA Alerts prior to drilling.

- Contractor is responsible for knowing the location of all buried and overhead utilities at the site. The Contractor shall field verify all underground utilities prior to any excavation.

- The Contractor shall take great care not to damage or disturb any underground utilities in the area. Any underground utilities damaged or disturbed by the Contractor shall be replaced and/or repaired in kind to the satisfaction of the Utility.
7.1.6 Safety

The Contractor shall take all necessary measures and observe all applicable laws and regulations of any public body having jurisdiction over the construction work to avoid injury to personnel, equipment, or existing surface and underground utility facilities. Errors or omissions on these specifications shall not be construed to relieve the Contractor from his responsibility to protect all surfaces, underground pipes, conduits, cables, or other structures.

The Contractor shall adhere to a Health and Safety Plan to be approved by the District prior to the commencement of any construction work. The Health and Safety Plan shall cover the equipment and procedures used for this project, but need not be site-specific. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the construction work. Every effort shall be made by the Contractor to minimize public disturbance and ensure the safety of the general public, District employees, and Contractor staff.

7.1.7 Final Cleanup

Before final acceptance, the well sites and all grounds occupied by the Contractor in connection with the construction work shall be cleaned of all rubbish, excess materials, and equipment, left in a condition free of rocks, cobbles and clods and graded to pre-construction lines and grades. Paved surfaces will be repaired using like materials. The site shall be cleaned and restored to the satisfaction of the Supervising Geologist.

7.1.8 Local Conditions and Geology

The monitoring wells are located in an area known locally as the Soquel-Aptos Basin. The hydrogeology of the Soquel-Aptos Basin is dominated by two units: the Pliocene to Upper Miocene Purisima Formation and the Quaternary Aromas Red Sands. The Purisima Formation is a relatively well structured collection of marine sandstones with siltstone and clay interbeds. The Aromas Red Sands are a comparatively unstructured, highly heterogeneous collection of fluvial, marine, and aeolian sands with lenses of silt and clay. Depth to groundwater in the area is expected to be range between approximately 10 feet bgs and 450 feet bgs.

Available well logs for monitoring wells that are to be destroyed are provided in Appendix A.
7.1.9 Contractor Qualifications

Contractor must possess a valid Class C-57 California Contractor's License and have experience in monitoring well installation and destruction; ideally within Santa Cruz County in the target formations. Contractor shall include in his/her costs, the cost to secure a City Business License and fire hydrant use permit, if required.

The subcontractor must have a demonstrated acceptable safety record. All work must be conducted in a safe manner in accordance with the California Code of Regulations Title 8 (CalOSHA) and any other local and federal requirements.
PART 2
MONITORING WELL DESTRUCTION

7.2.1 Pre-Destruction Preparation and Permitting

The Contractor shall follow procedures described in DWR Bulletins 74-81 and 74-90, including any later supplements, Santa Cruz County Ordinance 4901 and 5022, and Chapter 7.70 of Santa Cruz County Code relating to water wells, and other California state agency guidance. The goal of well destruction is to prevent the well from being a potential conduit for surface contamination or vertical mixing of groundwater.

Well destruction requires permitting through Santa Cruz County. Well destruction permit applications will be submitted to Santa Cruz County by the Contractor. The actual well destruction plan will be provided by Santa Cruz County and may differ from the below. The plan below is for bidding purposes.

Prior to the start of any well destruction operations, the Contractor shall submit the following information for each well for review and approval:

- A completed Well Permit Application, including payment documentation;
- A volume calculation of the well casing;
- A volume calculation of filter pack;
- An estimated volume calculation of open bottom; and
- An estimated volume of required sealing material.

Contractor shall maintain copies of all project permits at the construction sites.

Wells SC-10A and AA, SC-11A, B, C and D, and SC-18A and AA are nested wells. Copies of existing well boring logs, where available, are included in Appendix A. A summary of known construction details for the eight (8) wells that are to be destroyed is provided in Table 2.
Table 2: Construction Details for Monitoring Wells to be Destroyed

<table>
<thead>
<tr>
<th>District Well Number</th>
<th>Year Installed</th>
<th>Area</th>
<th>State Well Number</th>
<th>Depth to Groundwater, feet bgs</th>
<th>Casing Diameter (inches)</th>
<th>Screen Top, feet bgs</th>
<th>Screen Bottom, feet bgs</th>
<th>Gravel Pack (Top-Bottom), feet bgs</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC-10A</td>
<td>1983</td>
<td>Cherryvale</td>
<td>11S/01W-3B</td>
<td>16.6 12/19/2012</td>
<td>2-3/8</td>
<td>30</td>
<td>173</td>
<td>15-190</td>
</tr>
<tr>
<td>SC-10AA</td>
<td>1983</td>
<td>Cherryvale</td>
<td>11S/01W-3K</td>
<td>9.5 12/19/2012</td>
<td>6-5/8 to 280 ft bgs</td>
<td>2-3/8 to 436 ft bgs</td>
<td>296</td>
<td>436</td>
</tr>
<tr>
<td>SC-11A</td>
<td>unknown</td>
<td>Porter Gulch</td>
<td>None</td>
<td>387.3 12/19/2012</td>
<td>1</td>
<td>900</td>
<td>1000</td>
<td>885-1015</td>
</tr>
<tr>
<td>SC-11B</td>
<td>unknown</td>
<td>Porter Gulch</td>
<td>None</td>
<td>328.1 12/19/2012</td>
<td>1</td>
<td>500</td>
<td>600</td>
<td>485-615</td>
</tr>
<tr>
<td>SC-11C</td>
<td>unknown</td>
<td>Porter Gulch</td>
<td>None</td>
<td>182.4 12/19/2012</td>
<td>1</td>
<td>380</td>
<td>460</td>
<td>365-475</td>
</tr>
<tr>
<td>SC-11D</td>
<td>unknown</td>
<td>Porter Gulch</td>
<td>None</td>
<td>182.2 12/19/2012</td>
<td>1</td>
<td>200</td>
<td>300</td>
<td>185-315</td>
</tr>
<tr>
<td>SC-18A</td>
<td>1986</td>
<td>Main St.</td>
<td>11S/01W</td>
<td>58.0 11/26/2012</td>
<td>2</td>
<td>210</td>
<td>340</td>
<td>195-355</td>
</tr>
<tr>
<td>SC-18AA</td>
<td>1986</td>
<td>Main St.</td>
<td>11S/01W</td>
<td>65.6 10/18/2012</td>
<td>2</td>
<td>550</td>
<td>620</td>
<td>535-635</td>
</tr>
</tbody>
</table>

Note: Wells are believed to be constructed of schedule 40 PVC, with the exception of SC-10 which is constructed using schedule 40 low carbon steel. Surface completion is at-grade concrete with metal boxes.
7.2.2 Well Destruction Procedures

For bidding purposes, the following destruction procedures are planned:

- The well shall be sounded to verify that there has been no significant change in the well depth and confirm calculated volumes of sealing materials.
- All debris, silt and pumping hardware in well shall be removed prior to sealing. Silt shall be removed by surging, bailing, jetting, airlift or other appropriate means.
- Casing (below 5 feet), filter pack and annual seal materials may be left in place during sealing operations. The sealing material shall be placed within the casing, and forced out of the screened interval, under pressure, into the gravel envelope. During the pressure grouting procedure, a minimum of 25 pounds per square inch (PSI) must be maintained for five minutes or until pumping refusal.
- Completely seal the well with acceptable sealing material from the true bottom up to 5 feet of surface. Acceptable sealing materials are 237-sack neat cement, 10 sack cement grout, hydrated high solids 20 percent bentonite slurry. The type of sealing materials to be used shall be determined by Santa Cruz County.
- The seal shall be pressure-grouted in place using continuous distribution of grout that maintains an appropriate pressure.
- A tremie pipe shall be used to place the cement sealing material to avoid bridging. The tremie pipe should remain submerged at least twenty feet below the level of grout in the hole.
- The casing will be cut off and removed to a minimum of 5 feet bgs, with the excavation backfilled by compacted native material. The sealing material shall be allowed to spill over into the excavation to form a cap.
- All wastes must be properly managed, including waters generated during debris removal and seal placement.
- File a notice of completed work to Santa Cruz County or a copy of the DWR well report.
- Any deviations must be agreed upon by Santa Cruz County, the District and the Supervising Geologist.

The Supervising Geologist or licensed Contractor shall sign all documentation.
7.2.3 Sealing Requirements

This section provides additional details on sealing methods and requirements in accordance DWR Bulletin 74-81 and 74-90.

7.2.3.1 Tremie Pipe
All wells shall require the use of tremie pipe for placing sealing material into the bottom of the well. All tremie pipe shall be made of suitable rigid materials.

7.2.3.2 Failed Sealing Operation
If the total volume of the sealing material placed in the well is less than the calculated volume of the well, including the estimated volume of voids in the filter pack, the well destruction operation will be considered to have failed and corrective action shall be required to comply with state codes, or as otherwise directed.

7.2.4 Submittals

Submittals shall include but not be limited to the following:

Weight Tickets. The Contractor shall provide all weight tickets for County-approved sealing materials delivered for the well destruction.

Santa Cruz County Health Services Agency Well Permit Application. Contractor shall transmit two (2) copies of the Santa Cruz County Health Services Agency Well Permit to the District.

California Department of Water Resources Water Well Driller’s Report. Prior to final payment, the Contractor shall file completed reports with the California Department of Water Resources (DWR) in accordance with the provisions of the California Water Code. Contractor shall also transmit one (1) copy of both completed well driller’s reports to the District.
7.2.5 Sealing Material Design Mixtures

The sealing material (cement mixtures) to be used shall conform to one of the following specifications as defined in the California Water Well Standards DWR Bulletin 74-81 & 74-90.

- Sand cement: One 94 lb sack of type I/II Portland cement and 188 lbs of sand to 6 gallons of clean water.
- Neat cement: One 94 lbs sack of type I/II Portland cement to 6 gallons of clean water.
- Cement bentonite: One 94 lb sack of type I/II Portland cement and 1.88 lbs bentonite to 8 gallons of clean water.

7.2.6 Pressure Application to Sealing Material

During and after the placement of sealing material into well, by way of a 1” tremie pipe, appropriate pressure shall be applied and maintained. A pressure gauge shall be used to record and verify that appropriate pressure (i.e., 25 PSI for 5 minutes) has been attained. Additional sealing material shall be made available for topping off as required. Alternative pressurization application systems must be acceptable to the Supervising Geologist and Santa Cruz County.

7.2.7 Review and Approval

All work must be acceptable to the Santa Cruz County health officer and Supervising Geologist. Paperwork must be filed within five (5) working days to the DWR and Santa Cruz County, with copies to the District
7.3.1 Scope of Work

Well destruction must be completed prior to new well construction. The scope of this project consists of mobilization and demobilization at five sites, drilling thirteen (13) boreholes, geophysical logging, installing monitoring well casings and screens, placing filter packs and sanitary seals, well development, and wellhead completion.

Contractor shall furnish all materials, equipment, supplies, transportation, and labor, perform all operations, and conduct all work necessary to complete the five monitoring well clusters, consisting of thirteen (13) total monitoring wells in separate boreholes, all in accordance with the requirements of the Contract Documents, Santa Cruz County Health Services Agency regulations and Well Permit requirements, any and all applicable local codes, and the latest revision of California Department of Water Resources Bulletins No. 74-81 and 74-90, California Well Standards, and California Department of Toxic Substances Control Monitoring Well Design and Construction for Hydrogeologic Characterization (July 1995).

Contractor shall drill the well at the exact location designated by the District unless otherwise specified due to the existence of underground or overhead structures which preclude the safe operation of equipment. The Contractor shall ensure that each area is cleared by USA Alerts and a private utility locator prior to drilling. If there is any doubt related to utilities, the area will be hand dug for the top 5 feet.

The contractor shall properly install the materials described herein in accordance with these specifications. A typical well construction drawing is provided in Figure 11.

7.3.2 Well Drilling

The wells will be drilled by conventional direct-rotary drilling methods with drilling equipment of sufficient capacity to drill the 8¾-inch diameter borehole required by these specifications to a maximum depth of 1,000 feet. Specifications for each borehole can be found in Table 3. All drilling equipment including mast and drawworks, air compressors, drilling fluid pumps, drill pipe, etc., must be of requisite size, sufficient capacity, and suitable condition to drill and set casing to the anticipated depths.
Figure 11: Typical Monitoring Well Construction Details

- Water-Tight Well Vault
- PVC Flush-Threaded Well Casing
  - 4-inch diameter, Schedule 80
  - 1 foot
- 8.75 inch Diameter Borehole
- PVC Flush-Threaded Well Casing
  - 2-inch diameter, Schedule 80
  - length variable
- Casing Centralizer on blank casing
  - 40 feet apart
- “10-sack” Cement Sand
  - Slurry Sanitary Seal
- Bentonite Pellet Transitional Zone
  - 5 feet
- 10 feet of filter pack above screen
- PVC Flush-Threaded Well Screen
  - 2-inch diameter, Schedule 80
  - 0.040-inch slots, length variable
- Filter Pack, RMC #8, or equivalent
- 10 feet of PVC Flush-Threaded Casing Cellar
  - 2-inch diameter, Schedule 80
- Threaded End Cap
### Table 3: Estimated Boring and Well Depths for Monitoring Wells

<table>
<thead>
<tr>
<th>Well</th>
<th>Total Drilled Depth, feet bgs</th>
<th>Depth to Bottom of Sanitary Seal, feet bgs</th>
<th>Depth to Screen top, feet bgs</th>
<th>Screen Length, feet</th>
<th>Depth to Screen Bottom, feet bgs</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC-10RA</td>
<td>140</td>
<td>50</td>
<td>65</td>
<td>60</td>
<td>125</td>
</tr>
<tr>
<td>SC-10RAA</td>
<td>345</td>
<td>255</td>
<td>270</td>
<td>60</td>
<td>330</td>
</tr>
<tr>
<td>SC-10AAA</td>
<td>650</td>
<td>560</td>
<td>575</td>
<td>60</td>
<td>635</td>
</tr>
<tr>
<td>SC-11RA</td>
<td>1000</td>
<td>810</td>
<td>825</td>
<td>60</td>
<td>885</td>
</tr>
<tr>
<td>SC-11RB</td>
<td>615</td>
<td>525</td>
<td>540</td>
<td>60</td>
<td>600</td>
</tr>
<tr>
<td>SC-11RC</td>
<td>315</td>
<td>225</td>
<td>240</td>
<td>60</td>
<td>300</td>
</tr>
<tr>
<td>SC-18A</td>
<td>345</td>
<td>275</td>
<td>290</td>
<td>40</td>
<td>330</td>
</tr>
<tr>
<td>SC-18AA</td>
<td>645</td>
<td>555</td>
<td>570</td>
<td>60</td>
<td>630</td>
</tr>
<tr>
<td>SC-23A</td>
<td>855</td>
<td>765</td>
<td>780</td>
<td>60</td>
<td>840</td>
</tr>
<tr>
<td>SC-23B</td>
<td>665</td>
<td>575</td>
<td>590</td>
<td>60</td>
<td>650</td>
</tr>
<tr>
<td>SC-23C</td>
<td>255</td>
<td>185</td>
<td>200</td>
<td>40</td>
<td>240</td>
</tr>
<tr>
<td>SC-A9A</td>
<td>715</td>
<td>625</td>
<td>640</td>
<td>60</td>
<td>700</td>
</tr>
<tr>
<td>SC-A9B</td>
<td>535</td>
<td>465</td>
<td>480</td>
<td>40</td>
<td>520</td>
</tr>
</tbody>
</table>

Note: All depths are subject to change based on field conditions. If the lithologic and geophysical logs suggest the screens cross multiple zones, screen length will be shortened so that they represent a single unit.

#### 7.3.3 Casing Depth

The estimated casing depths are shown in Table 3. The final monitoring well casing depths will be determined by the Supervising Geologist from an examination of the hydrogeologic data and borehole samples. For bidding purposes, the quantity of each Work Item shall be in accordance with the Bid Schedule.

#### 7.3.4 Stratigraphic Log

A stratigraphic log shall be prepared by the Supervising Geologist to accompany the set of formation samples from the deepest well boring at each site. The log shall note depth, strata thickness, lithology (i.e., soil, rock type), and include grain size, shape of constituent particles, color, relative plasticity (for clay/silt mixtures), relative density (for sand/gravel mixtures), rate of penetration, and other pertinent information. Contractor shall cooperate and provide assistance as required in collecting data or
preparing the stratigraphic log. Intervals for collecting cuttings for logging the deep well boring shall be every ten (10) feet or at significant changes.

The stratigraphy observed in the deep well boring at each site will be the assumed stratigraphy for other borings at that site. While drilling of the intermediate and shallow boreholes, the Contractor shall collect lithologic samples every 10 feet to allow verification of the stratigraphy. Geologist will supply bags for the lithologic samples collected by the driller. The Contractor will alert the Supervising Geologist to any significant deviations from the expected stratigraphy in the shallow and intermediate boreholes, particularly in and around the anticipated screened intervals.

7.3.5  **Borehole Geophysical Logging**

Contractor shall provide geophysical logging of the deep well boring at each of the five sites for the purpose of screen location and identification of saline water. Geophysical logs to be provided shall include spontaneous potential, 16- and 64-inch normal resistivity, and natural gamma.

Contractor shall submit all logging results to the Supervising Geologist. Final logging results shall be provided in digital LAS and ASCII formats. One field copy of each log must be provided to the Supervising Geologist immediately upon the completion of the geophysical logging work.

If the logging probe fails to descend to the desired depth, the Contractor, at their own expense, shall condition the hole and permit the logging probe to descend to the bottom of the hole. Standby time will not be paid for additional cleaning and conditioning of the hole to enable logging operations to proceed.

7.3.6  **Monitoring Well Casings**

Monitoring wells are to be completed in each of the thirteen (13) boreholes. Monitoring well casing material shall be Schedule 80 PVC for all wells. Casing joints shall be flush threaded.

All monitoring wells shall be 2-inch nominal diameter, with the upper foot below ground surface being 4-inch nominal diameter to provide additional space for placement and access to dedicated monitoring equipment. The actual length of each monitoring well casing to be installed shall be determined by the Supervising Geologist from review of geophysical logging data and formation samples.
Centralizers shall be of the same material as the monitoring well casing or other non-conductive material (steel may not be used), and shall be located at the top and bottom of the screened interval. Centralizers shall be located every 40 feet along the sections of blank casing.

7.3.7 Well Screens and End Fittings

Monitoring well screen material shall be Schedule 80 PVC for all wells. Well screens size is based on existing wells in the area and shall consist of horizontal machine-cut 0.040-inch slots. Table 3 lists the screen lengths for each well. Casing joints shall be flush threaded with no adhesives. Monitoring well screen strength shall be sufficient to withstand all anticipated forces imposed on the screens during installation, isolation seal placement, well development, and use. The nominal and inside diameters of the monitoring well screens shall correspond to that of the monitoring well casings.

The final placement depths and lengths of monitoring well screens shall be determined by the Supervising Geologist from review of geophysical logging data and formation samples.

End fittings shall be fabricated from new materials and be of the same materials as the monitoring well casing. The bottom of each monitoring well screen shall be fitted with a 10-foot cellar pipe made of blank monitoring well casing, with a threaded end cap.

7.3.8 Filter Pack

All filter pack material shall be 8x16 Filter Pack manufactured by RMC, Silica Resources, or equivalent. Filter pack material shall be clean, hard, predominantly (>90%) siliceous, water-worn, and sub-rounded to rounded. Delivery and storage methods should ensure that materials are protected from the weather and do not come in contact with the ground or other contaminating materials.

Unless directed otherwise by the Supervising Geologist, filter pack shall extend from 5 to 10 feet below the bottom of the monitoring well screen to 10 feet above the monitoring well screen. The finished length of each filter pack interval shall be determined by the Supervising Geologist from review of geophysical logging data and formation samples.
Contractor shall be responsible for supporting and anchoring the well casing in such a way as to hold it in place during the placement of gravel and annular seals. The bottom of the casing shall be at a sufficient distance above the bottom of the hole to ensure that the casing is held in tension, and none of the weight of the casing is supported from the bottom of the hole. Float plugs shall not be used to land and set casing.

After a casing string has been suspended in the hole, the placement of the filter pack shall proceed without delay. The filter pack material shall be placed by a tremie pipe lowered to the bottom of the annular space between the outside of the casing and the wall of the well bore. Tremie pipe shall be flush threaded to help prevent damage to the monitoring well casings during filter pack placement.

As filter pack material is poured into the tremie pipe, re-circulating water shall also be introduced to help carry the material. The tremie pipe shall be slowly raised as the material fills the annular space. The volume of filter pack material introduced into the well shall be not less than the computed volume of the annular space between the outside of the casing and the wall of the hole. The height of the filter pack shall be checked periodically with a sounder to ensure that the volume of filter pack installed is nearly equivalent to the computed amount. The Contractor shall accurately measure the volume of filter pack added to the well.

7.3.9 Grouting and Sealing

Well grouting and sealing shall be in accordance with the following requirements, and the precedence as shown:

- Santa Cruz County Health Services Agency regulations and Well Construction Permit.
- The latest revision of the California Department of Water Resources Bulletin No. 74, California Well Standards, and
- Contract Documents.

All tremie pipe used in the placement of any seal shall be flush threaded to help prevent damage to the monitoring well casings during sealing operations. A 5-foot bentonite transitional seal shall be placed above the top of the filter pack. Sealing material above the bentonite seal and below the surface seal shall consist of cement-bentonite grout for all seals. To reduce the heat of hydration, the cement-bentonite grout shall include approximately 5% bentonite by weight. No accelerators shall be used.
Water used to prepare sealing mixtures shall be of drinking water quality and shall be free of petroleum products, suspended material, and other deleterious substances.

7.3.10 Seal Placement

Location and Length: The final location and vertical length of each seal shall be determined by the Supervising Geologist from evaluation of borehole cuttings and geophysical logs. Unless directed otherwise by the Supervising Geologist, a seal consisting of bentonite shall extend from the top of the filter pack to 5 feet above the filter pack. The cement-bentonite grout seal shall extend from the top of the bentonite seal to the surface.

Preparation: Prior to placing any annular material, the borehole shall be circulated clean of all sediment and the drilling mud conditioned to the satisfaction of the Supervising Geologist.

Seals: Unless otherwise directed by the Supervising Geologist, each interval to be sealed shall be filled with grout, from bottom to top in one continuous operation. The grout shall be placed through a tremie pipe, by positive displacement pumping. The discharge end of the tremie pipe shall remain below the level of the grout in the borehole throughout the placement. The tremie pipe shall be maintained full of grout at all times. Each monitoring well casing shall be filled with water during each sealing operation. Monitoring well casings shall be kept full of water as recommended by the sealing-material manufacturer after completion of each sealing operation.

Grout Set Time: Upon installation of each seal, no further Work shall be completed on the well for 24 hours.

7.3.11 Wellhead Completion

The monitoring well shall be terminated below ground surface (below grade) and covered with a bolt-down traffic box securely cemented into place as shown on Figure 11. The traffic box shall be completed ½ to 1 inches above ground surface to prevent ponding around the well. The traffic box shall be so installed as to permit easy access for instrumentation, monitoring, or sampling. A sufficient number of weep holes or a
gravel drain shall be placed in the well box subgrade so that any condensation or liquid is readily drained from the valve box, thus preventing ponding.

Upon completion of the well, the Contractor shall install a water-tight locking well cap at the top each monitoring well. The District well number shall be clearly affixed in the outside concrete.
7.4.1 Permits and Licenses

Contractor shall obtain a Well Drilling Permit from the Santa Cruz County for the thirteen (13) wells. Contractor shall coordinate with any permitting inspectors as permits or regulations require. A hydrant use permit may be required. Contractor shall maintain copies of all project permits at the construction sites.

7.4.2 Submittals

Submittals shall include but not be limited to the following:

Santa Cruz County Health Services Agency Well Permit Application. Contractor shall transmit two (2) copies of the Santa Cruz County Health Services Agency Well Permit to the District.

California Department of Water Resources Water Well Driller’s Report. Prior to final payment, the Contractor shall file completed reports with the California Department of Water Resources (DWR) in accordance with the provisions of the California Water Code. Contractor shall also transmit one (1) copy of both completed well driller’s reports to the District.

7.4.3 Mobilization/Demobilization

Mobilization includes the purchase of contract bonds as per the Contract Document, assembly, and transportation of all necessary tools, equipment, personnel, and materials to and from the work sites to perform all work required under these specifications. It also includes the site work necessary to accommodate the well drilling, casing installation, sealing operations, development, and all other work on the grounds occupied by the Contractor. Mobilization shall include installing any necessary security fences and signs, initiating traffic control, and installing any required water or runoff control. Demobilization shall include removal of all equipment, materials, and temporary facilities installed during all phases of the construction work.
7.4.4 Drilling Commencement Time and Notification

Contractor shall notify the Supervising Geologist at least one (1) hour in advance of the commencement of each day of drilling. If drilling is not ready to commence prior to 2:00 p.m. (and notification given by 12:00 noon), drilling shall not commence until 7:00 am the following morning. Any non-productive time elapsing between notification and actual commencement of drilling will not constitute standby time.

Contractor shall conduct construction operations on a 12-hour per day basis, 7 am to 7 pm, until initial development is complete. Wells shall be installed sequentially as part of the same mobilization.

7.4.5 Site Cleanliness

During the progress of construction, Contractor shall keep the premises in a neat and clean condition, and free from any unsightly accumulation of rubbish on a daily basis. Upon completion of the Work, Contractor shall satisfactorily dispose of or remove from the vicinity of the construction sites all rubbish, unused materials, and all other equipment or materials belonging to the Contractor or used under Contractor’s direction during the construction. Site shall be cleaned and restored to the satisfaction of Santa Cruz County and Supervising Geologist.

7.4.6 Drilling Fluids

All drilling fluids shall be acceptable for water well drilling in accordance with AWWA A100 and shall use potable water. All drilling fluid additives, including those proposed for use in the event of lost circulation shall be approved in advance by the Supervising Geologist. Contractor shall supply Material Safety Data Sheets (MSDS) for all proposed additives.

Contractor is responsible for providing and paying for water required for all Contractor’s needs. Water is available as described below:

- SC-23 (Quail Run): Water to be trucked in;
- SC-11 (Porter Gulch): Water to be trucked in;
- SC-A9 (Larkin Valley): Available onsite from tank;
- SC-10 (Cherryvale): Water to be trucked in; and
- SC-18 (Main Street): Available onsite.
Air-gaps must be maintained and volumes used must be recorded. Contractor is responsible for obtaining any required water metering device from the City or District.

7.4.7 Disposal of Drilling Fluid, Cuttings, and Discharge Water

Contractor shall be responsible for properly disposing of drilling fluid, cuttings, and discharge water resulting from the construction operations.

All materials shall be disposed of off-site. Discharge water shall be stored and settled in on-site storage tanks with clear water and discharged to storm sewers or land in conformance with all applicable local, state, and federal requirements and standards. Clear fluids can be disposed of in accordance with the District’s existing NPDES permit, Water Board Order No. R3-2011-0223, adopted December 9, 2011. Contractor is responsible for providing adequate methods and materials for meeting the discharge requirements in Appendix B. All solids shall be disposed of off-site by Contractor. A summary of the discharge locations for each site are listed below:

1. Quail Run (SC-23) – storm drain
2. Porter Gulch (SC-11) – ground
3. Larkin Valley (SC-A9) – ground
4. Cherryvale (SC-10) – nearby nursery or field
5. Main Street (SC-18) – onsite backwash basin or sewer

7.4.8 Development Methods

Contractor shall airlift wells until discharge is clear. Air lifting will proceed from the top of water column to the bottom of the screen interval, if possible. Contractor shall provide enough pipe to lower the air line to the bottom of the screened interval. At the Supervising Geologist’s discretion, development with the air pipe above the screened interval may be adequate for complete development. The following general development procedures should be followed:

1. Record static water level and total well depth.
2. Set the pump and record pumping rate and turbidity. Air-lift until turbidity (as measured by a nephelometer) reaches acceptable levels or stabilizes.
3. Measure depth to the bottom of well. Remove excess sediment by bailing.
Air-lifted water shall be directed to a temporary containment vessel. Water shall be allowed to settle until all appropriate discharge criteria are met. Water can then be discharged in accordance with the relevant NPDES permit.

7.4.9 Temporary Cover

During periods when no work is being done on the well, such as overnight, or while waiting for material to set, the well and surrounding excavation, if any, shall be covered. The cover shall be sufficiently strong and well anchored to prevent the introduction of foreign material into the well.

7.4.10 Protection of Groundwater Resources

Contractor shall take all necessary precautions during the construction period to prevent foreign objects, contaminated water, gasoline, or any other contaminant from entering the borehole or any casings, either through the opening or by seepage through the ground surface.

7.4.11 Electric Power

All electric power required on the part of the Contractor during the performance of the Work called for under these specifications, or any operations appurtenant thereto, shall be furnished by the Contractor at the sole expense of the Contractor.
APPENDICES

A. Available Well Logs

B. Discharge Requirements
Figure A-2: SC-11 Well Location in Cluster (Porter Gulch)

The bottom of B, C, & D appears to contain lots of muddy water.
Figure A-3: SC-18 Well Drillers Log (Main Street)

<table>
<thead>
<tr>
<th>OWNER: Name</th>
<th>SOQUEL WATER DISTRICT</th>
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<tbody>
<tr>
<td>Address</td>
<td>P O BOX 158</td>
</tr>
<tr>
<td>City</td>
<td>SOQUEL</td>
</tr>
<tr>
<td>Zip</td>
<td>95073</td>
</tr>
<tr>
<td>County</td>
<td>SANTA CRUZ</td>
</tr>
<tr>
<td>Well address</td>
<td>Main St (see attached)</td>
</tr>
<tr>
<td>Township</td>
<td>11 S N 1 W</td>
</tr>
</tbody>
</table>

| WELL LOG: Total depth 575 ft, Depth of completed well 630 ft |
|--------------------|------------------|
| 0 - 7               | clayey silty sanddk bwn |
| 7 - 30              | silty sand/sandyellow bwn |
| 30 - 40             | sandy gravel with silt |
| 40 - 60             | sand with silt light gray |
| 60 - 90             | gravelly sand light brn gray |
| 90 - 100            | sandy gravel w/ silt |
| 100 - 160           | gravelly sand gray brn gray |
| 160 - 180           | mud mud, sandy gravel gray |
| 180 - 210           | silty clayand sand dk gray |
| 210 - 220           | clayey silty and sand gray |
| 220 - 240           | clayey silty and sand gray |
| 240 - 300           | sandy clay; gray |
| 300 - 330           | clayey sand; gray |
| 330 - 350           | silty clayey sand; gray |
| 350 - 370           | silty clayey sand; dk gray |
| 370 - 390           | silty sandy gray |
| 390 - 410           | \[--- perforations---\] |

<table>
<thead>
<tr>
<th>WELL LOCATION SKETCH</th>
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<tbody>
<tr>
<td>See attached</td>
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<th>EQUIPMENT:</th>
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<tbody>
<tr>
<td>Rotary</td>
</tr>
<tr>
<td>Cable</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Size</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>WELL SEALS:</th>
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<tbody>
<tr>
<td>Method of sealing</td>
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<tr>
<td>Distance after well completion</td>
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</tbody>
</table>

<table>
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<tr>
<th>WELL DRILLER'S STATEMENT:</th>
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<tbody>
<tr>
<td>Eaton Drilling Co, Inc</td>
</tr>
<tr>
<td>P O BOX 975</td>
</tr>
<tr>
<td>WOODLAND</td>
</tr>
<tr>
<td>95423</td>
</tr>
<tr>
<td>Date of this report</td>
</tr>
</tbody>
</table>

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM
Figure A-4: SC-10 As-Built Diagram (Cherryvale)