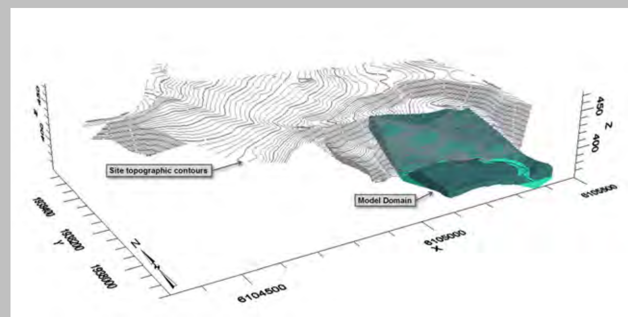
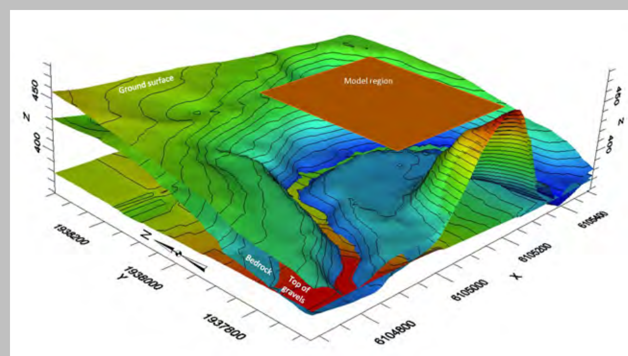
APPENDIX I

Hydrogeologic Assessment of Construction Dewatering

Hydrogeologic Assessment of Construction Dewatering at Parkside Trails





Prepared For: Standard Pacific Homes

Prepared by:
Mark Woyshner, MScEng
Gustavo Porras
Barry Hecht, CEG, CHg

Balance Hydrologics, Inc.®

April 2014

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1 INTRODUCTION

Standard Pacific Homes is planning the development of 18 single-family residential lots, supporting street, infrastructure and a water quality basin at the Parkside Trails site, located off of Stevens Canyon Road, approximately 4,000 feet downstream of Stevens Creek Dam, in the City of Cupertino, California (**Figure 1**). The property was previously used as a vineyard and then an orchard, and then later used for haul road access to a sand and gravel quarry until the mid-1970s. The site is located on the on the north side of Stevens Creek and the quarry was located on the south side of Stevens Creek. The original topography of the site was modified by grading of the former quarry haul road and filling of the former steep canyon slopes and a significant portion of the alluvial terrace located north of the creek crossing. Between 1997 and 1999, the City of Cupertino took the lead on a restoration and cleanup project that included removal of debris and undocumented fill from the creek. The current proposed project includes below grade earthwork, excavation and re-engineering of the fill (ENGEO, 2013).

The corrective grading plan (ENGEO, 2013) proposes a groundwater cut-off wall and possible temporary shoring elements where the excavation is below the groundwater elevation. The cut-off wall is essentially a 2-foot wide trench located on the creek side of the area of excavation, which is backfilled with a bentonite slurry (or similar low permeability material). By having a permeability orders of magnitude lower than the alluvial aquifer, its intent is to significantly reduce the seepage of groundwater to the excavated area, and reduce the risk of potential significant losses of water from Stevens Creek. Other alternatives considered in the ENGEO report include a sheet pile wall or a deep soil bentonite mix wall.

The scope of this report was to assist Standard Pacific Homes and ENGEO with the understanding of (a) the effect of construction dewatering to shallow groundwater flow in the vicinity of the proposed Parkside Trails site, (b) whether changes to groundwater flow will substantially affect flows in Stevens Creek, and (c) how the design of the proposed cutoff-wall mitigation might affect these effects. The approach of the study was to:

(1) develop a concept of groundwater flow using regional local and geologic data,
(2) conduct a pumping test (also called an aquifer test) of the shallow groundwater on site, and
(3) using results of the test (and other published data), develop a basic groundwater flow model with which to assess groundwater flow conditions with and without the cut-off wall mitigation.

This effort also helps define baseline hydrogeologic conditions at the site.

1.1 Objectives and scope of the investigation

The technical objectives of the aquifer test were to measure the response of groundwater elevations from a pumping stress, and using the drawdown data to estimate aquifer parameters of specific capacity (Cs), transmissivity (T) and storage coefficient (S). A pumping well was installed, followed by a short-duration step test was conducted to plan the aquifer test. A 50-hour constant-rate pumping test was then conducted which included: (a) the measurement of static (non-pumped) groundwater elevations in the pumped well and observation wells prior to the test; (b) measuring water-level drawdown while pumping the well at a constant rate; and (c) after pumping the well, measuring water-level recovery. Data collected were analyzed using the modified nonequilibrium equation graphical method (Cooper and Jacob, 1946) to estimate T and S. Recharge and bedrock boundaries were also evaluated.

The measured aquifer parameters were used to model shallow groundwater flow appropriate for site planning. The objectives of the groundwater model were to develop a conceptual understanding of groundwater flow at the site, quantify potential groundwater flow to the excavated area and from Stevens Creek, and guide selection of mitigation measure, if needed, appropriate to this site.

1.2 Acknowledgments

We appreciate the assistance of Brooks Ramsdell from ENGEO with the development of the scope of this investigation. He also installed two monitoring wells that we used as observation wells during the aquifer test, and provided us with borehole and test-pit logs and CAD files of the site.

2 GEOLOGIC FRAMEWORK

The site is geologically within the Santa Cruz Mountains, which have been uplifted along a series of thrust faults which separate them from Santa Clara Valley floor. The nearest is the Monte Vista fault, (East Systems Consultants, 1985; Brabb, 2000) approximately 800 to 1000 feet to the north, which has raised the block to the south, and tilted it such that the underlying sediments at the base of the alluvial are now dipping 20 to 70 degrees to the south. The fault is considered active. Uplift has been ongoing and gradual, such that Stevens Creek has left four distinct terraces (Hitchcock and others, 1994, evidence that the creek has been meandering across its valley for hundreds of thousands of years, or longer. The geologic history could potentially lead to anomalous conditions beneath the site.

The site was recently characterized by ENGEO (2013) with (a) geologic field mapping, (b) ten borings ranging from approximately 15½ to 50 feet below existing grade, and (c) twenty test pits dug to a maximum depth of ten feet (**Figure 2**). The findings were summarized in a site plan and six geologic cross sections. The site is accessed from Stevens Canyon Road at an elevation of about 470 feet (NGVD29) and slopes southeast towards Stevens Creek to about 374 feet (NGVD29). A prominent topographic feature is found within the southeast portion of the site. It was described as a bowl-shaped cut-bank erosional feature, partially filled with young alluvial sediments (Qal) and recently overlain with undocumented fill (Qaf). Steeper slopes are generally found around the perimeter of this cut-bank feature, extending up to alluvial terrace deposits (Qt) on the north portion of the site. Steeper slopes are also found down to Stevens Creek from this feature, and down to the creek from the alluvial terrace and fill deposits on the west portion of the site. Some older alluvium (Qoal) was characterized in the center portion of the site, west of the cut-bank feature. Bedrock underlying the alluvium and terrace deposits was identified as Santa Clara Formation (QTsc), which also outcrops along the bank of Stevens Creek and along the steep perimeter slopes of the bowl-shaped feature.

Groundwater was found in the alluvial deposits of the cut-bank feature. Alluvium was 9 feet thick in boring B-1, 18 feet thick in B-2, 15 feet thick in B-3, and 23 feet thick in boring

2-B1. The alluvial deposits encountered were generally loose to medium-dense, sand, silty sand, and gravel. In monitoring well MW-1, the alluvium was a thickness of 18 feet (12 feet of gravel overlain with 6 feet of clay with sand), and in MW-2, the alluvium was 14 feet (6 feet of gravel overlain with 8 feet of sandy clay). Groundwater was found in the gravels. In addition to the well locations, gravel deposits were encountered at borings B-2 and B-3 (at a thickness of 5 feet) and at 2-B1 (at a thickness of 3 feet), and at all sites, gravels were on bedrock and overlain by finer alluvium. These alluvial gravel deposits are at a similar elevation as the Stevens Creek and most likely connected to it. The proposed groundwater cut-off wall is intended to limit groundwater flow through the gravel deposits during excavation.

3 INSTALLATION OF WELLS AND AQUIFER TEST PREPARATION

The well locations were selected in the center of the bowl-shaped erosional feature (**Figure 2**), where gravel deposits were expected to be reasonably thick (based on previous borings), and where there was reasonable access for the well drill rig. Monitoring wells MW-1 and MW-2 were first installed 20 feet apart under direction of Brooks Ramsdell at ENGEO. We then followed with the installation of the pumping well, located 19 feet from MW-1 and 40 feet from MW-2. The pumping well was located at the approximate location of the groundwater cut-off wall, and all three wells are in-line with geologic cross Section 5-5' (**Figure 3**), described in the geotechnical report by ENGEO (2013).

Monitoring wells MW-1 and MW-2 were installed by Britton Exploration under contract with ENGEO Inc. Drilling of the boreholes and the installation of the wells was logged by J. White. Well MW-1 was drilled on February 4, 2014 using a hollow-stem auger. For the first 28 feet, the driller encountered fill material. From 28 to 34 feet, alluvium (clay with sand) was encountered. From 34 feet to the bottom of the borehole the driller encountered gravels with sand and silt. The bottom of the boring was at 46 feet bgs, not reaching the sandstone bedrock (Santa Clara Formation) because of drilling refusal. Well MW-2 was drilled on January 31, 2014 using a hollow-stem auger. For the first 28 feet, the driller encountered fill material. From 28 to 37 feet, alluvium (sandy clay) was encountered. From 37 to 43 feet the driller encountered gravels with silt. From 43 ft. to the bottom of the borehole at 46 feet bgs, the driller encountered sandstone bedrock (Santa Clara Formation).

Gregg Drilling & Testing, Inc. under contract to Balance Hydrologics, Inc. drilled the pumping well (identified as well 2014-1) on Tuesday February 18, 2014 using a truck mounted D55 hollow-stem auger. Balance staff (Gustavo Porras) observed the installation of the well, characterized and logged the drill cuttings (**Appendix A**). The borehole was drilled to 60 feet below ground surface (bgs) with an 8-inch hollow-stem auger. For the first 42 feet, the driller encountered fill material (gravelly silty clays). From 42 to 50 feet bgs the driller encountered gravels up to 1.5 inches in diameter with occasional boulders and clay. From 50 ft. to the bottom of the borehole, the driller encountered dark bluish gray silty sandstone (Santa Clara Formation). The bore hole was re-drilled to the same depth with a 12-inch hollow-stem auger to widen it for the installation of a 6-inch diameter well casing,

Well 2014-1 was constructed with 6-inch diameter PVC casing to a total depth of 60 feet bgs with a stick up of 2.7 feet above ground surface and with slotted casing in the lower 20 feet. A filter pack using Lapis #3 sand was installed in the well annulus from the bottom of the well to two feet above the slotted casing, and then overlain with two feet of bentonite. A neat cement seal was placed with tremie method and inspected by Santa Clara County personnel. The well completion report and the hydrogeologic log of well 2014-1 can be found in **Appendix A**.

Well 2014-1 was developed on February 21, 2014. The well was bailed twice prior to surging with a surge-block. The well was then bailed again before a pump rated for up to 35 gallons per minute (gpm) was installed. Water was pumped at an initial rate of 2 gpm increasing gradually over 2.7 hours to a rate of 10.1 gpm when the water level reached the pump. The pumping rate was reduced to a stable pumping rate between 7.5 and 8 gpm. All the water pumped was discharged to a small meadow north of well 2014-1 where water was ponded and contained using straw wattles and silt fencing. No water flowed to Stevens Creek which was at least 200 feet away.

Pumping and monitoring well locations and construction specifications are summarized in **Table 1**. All wells were equipped with an automated water-level recording datalogger (Levelogger ®) after the pump was installed prior to the start of the aquifer test. The leveloggers were programmed to record a water-level measurement every 5 minutes. The flow meter was also attached to a datalogger, which was programmed to record every 15 minutes the volume of water pumped.

3.1 Discharge permitting

To discharge groundwater pumped from well 2014-1 to Stevens Creek during the aquifer test, we worked with Sue Ma and Selina Louie at the Regional Water Quality Control Board (RWQCB) and Cheri Donnelly at the City of Cupertino to acquire a C.15

conditionally exempted non-stormwater discharge under the Municipal Regional Stormwater Permit. Per RWQCB Order No. R2-2009-0074 (revised 11/28/2011), our discharge of pumped groundwater was conditionally exempted under Section C.15.b.i.(2), requiring analysis of the groundwater for the following methods: (a) USEPA Method 160.2 for total suspended solids; (b) USEPA Method 8015 Modified for total petroleum hydrocarbons; (c) USEPA Method 8260B and 8270C or equivalent for volatile and semi-volatile organic compounds; (d) USEPA Method 3005 for metals; (e) pH and turbidity. Laboratory detection limits of the analyses corresponded to Table 2 Trigger Pollutants in RWQCB Order No. R2-2012-0060 [General Waste Discharge Requirements for Discharge or Reuse of Extracted Brackish Groundwater, Reverse Osmosis Concentrate Resulting from Treated Brackish Groundwater, and Extracted Groundwater from Structural Dewatering Requiring Treatment].

The water from well 2014-1 was sampled on February 21, 2014 following development of the well. Analytical results from the laboratory (**Table 2**) were either not detected (ND) or below the trigger pollutant level. We received an email from the RWQCB on March 12, 2014 stating that the proposed discharge was conditionally exempted from regulation under the City of Cupertino's municipal stormwater permit, provided the proposed discharge is not a source of pollutants to receiving waters and the flow and total volume of the proposed discharge have no negative impacts on the receiving waters. The following permit conditions were met:

1. The discharged groundwater shall not exceed 50 NTUs for discharge to a dry creek, 110 percent of the ambient stream turbidity for a flowing stream with turbidities greater than 50 NTU, or 5 NTU above ambient turbidity for ambient turbidities that are less than or equal to 50 NTU. At least three samples from the receiving water shall be tested for turbidity prior to any discharge to determine ambient turbidity.
2. The pH of the discharged groundwater shall be maintained within the range of 6.5 to 8.5.
3. Water samples shall be collected and analyzed for turbidity as outlined in your proposal on a daily basis. Daily pH and flowrate measurements, as well as the total volume of groundwater discharged, shall be monitored also.

4. The results of the monitoring described in 3. above shall be reported to the Water Board within 2 weeks of the end of pumping. (Monitoring results are summarized in **Table 3**.)
5. The number of days groundwater is discharged to the storm drain shall not exceed 7 days. A log of the monitoring and sampling results shall be maintained at all times.
6. If any water samples fail to meet the specified requirements in item 1 and 2 above, the discharge will be terminated immediately.
7. The discharged groundwater shall not cause pollution, contamination, nuisance, and/or scouring or erosion at the point of discharge into the receiving waters.
8. The discharged groundwater shall not have a negative impact on the receiving waters because of the flowrate or the total volume of discharge.

4 AQUIFER TEST CONDUCTED

Well 2014-1 was fitted with a Grundfos 0.5 HP submersible pump on March 17, 2014 by Gregg Drilling. A step-test was conducted on March 18, 2014 for 8 hours to assess an appropriate pumping rate for the aquifer test. At pumping rates not much greater than nine gpm during the step test, we noted water levels lower than the depth of bedrock and cascading water in the well. A constant-rate pumping test (also called an aquifer test) was conducted in well 2014-1 at an average flow rate of 8.8 gallons per minute (gpm) for 51.5 hours.

The pumping portion of the aquifer test began on March 19, 2014 and continued through March 21. All water pumped from the well was discharged approximately 200 feet south from the well to the bank of Stevens Creek (**Figure 5**). All discharged water infiltrated to the ground and with no runoff to Stevens Creek. Drawdown recovery was monitored starting when the pump was turned off on March 21 through March 24, when all leveloggers were demobilized and data recovered.

Figure 6 shows the water-surface elevation of the pumped well 2014-1, monitoring wells MW-1 and MW-2, from March 17, prior to and during the aquifer test. The static head (non-pumped groundwater elevation) was almost the same in all three wells, with the elevation of Stevens Creek at a higher elevation, indicating a groundwater flow gradient from Stevens Creek to the area proposed for excavation. A small portion of groundwater flows through this area and then back to Stevens Creek further downstream (see groundwater modeling section below). When well 2014-1 was pumped, this gradient increased, potentially increasing groundwater flow through these lateral gravels from the area beneath the creek.

4.1 Aquifer properties

Drawdown during the aquifer test was recorded in the pumped well 2014-1 and in the two monitoring wells. Data collected from the three wells were analyzed using the modified nonequilibrium equation graphical method (Cooper and Jacob, 1946) to estimate transmissivity (T) and storage coefficient (S). At the pumping rate of 8.8 gallons per minute (gpm), the calculated time to evacuate water contained in casing storage of well 2014-1 was seven minutes, after which results are more reflective of the aquifer properties. After 24 hours of pumping, the drawdown in the pumping well was four feet. Using four feet of drawdown at 8.8 gpm, the specific capacity (Cs) of the well is 2.2 gpm per foot of drawdown. Transmissivity (T) is a common aquifer coefficient that characterizes how easily water moves through the aquifer (a measure of permeability), and can be used to quantify groundwater flow. Transmissivity can be initially estimated with a relationship to Cs,[1] then refined with dynamic data from the aquifer test. Aquifer transmissivity was calculated using four data sources from the aquifer test:

1. From the pumping well data (**Figure 7**), the slope of the time-drawdown curve after the critical casing storage time was used to calculate T.
2. In a similar way, T was calculated using the time-drawdown data recorded in the two monitoring wells MW-1 and MW-2 while pumping well 2014-1 (**Figure 8**).
3. Transmissivity was also calculated as using the recovery data from the pumped well 2014-1 and from the two monitoring wells (**Figure 9**). Calculations of T using recovery data is generally regarded as more accurate because the data are not affected by pump fluctuations and vibrations, and various other possibilities for error related to pumping.
4. And finally, transmissivity was independently calculated using the distance-drawdown method (**Figure 10**). We used drawdown in the pumped well and the two monitoring wells at 3,033 minutes of pumping. This method yielded the highest transmissivity.

Hydraulic conductivity (K, also known as permeability) is used in the groundwater flow model and was estimated by dividing T by the aquifer thickness (b), which is the depth to bedrock minus the depth to static water level. The aquifer thickness was ten feet at the pumped well 2014-1. Using the time-drawdown data, K averaged 4.5 x 10^{-2} centimeters per second (cm/s), while with the recovery data, K averaged 4.0 x 10^{-2} cm/s. Using the distance-drawdown method K was 1.0 x 10^{-1} cm/s. The storage coefficient (S) was calculated using drawdown data from monitoring wells (**Figure 9**) and averaged 0.29. Results of the T, K and S calculations are summarized in **Table 4**.

---

[1] Specific capacity (Cs) is well function describing the quantity of water that a well can produce per unit drawdown of water level in the well. It is the pumping rate divided by the water level drawdown in the well, in gallons per minute per foot drawdown. To estimate aquifer transmissivity (T) with Cs see Appendix 16.D of Driscoll (1983) or p. 128 of DWR Bulletin No. 118-2 (June 1974). If the 24-hour Cs is used, then T = 1,500 * Cs = 1,500 * 2.2 = 3,300 gpd/ft.

4.2 Boundary effects

When a well is pumped it introduces a stress to the aquifer and lowers hydraulic pressures and water levels in the vicinity of the well. With continued pumping, this effect propagates outward from the well, which can be conceptually represented as a "cone of depression". A recharge boundary results in reduced drawdown after the cone of depression encounters a stream, lake, or other recharge source, while a no-flow or low-permeability boundary result in increased drawdown after the cone of depression encounters a zone of lower permeability due to causes such as a change in lithology or a fault. Neither a recharge boundary from Stevens Creek nor a bedrock boundary was apparent from the pumping data. We discuss this finding further in the groundwater modeling section (below).

The distance to an aquifer boundary can be estimated using the Cooper-Jacob (1946) distance-drawdown equation, which is an approximation of the Theis (1935) analytical model discussed above. Based on the estimates of transmissivity and storage (discussed above), the radius of influence from pumping well 2014-1 at 8.8 gpm should just reach Stevens Creek in about 50 hours (**Table 5**). Bedrock may also be encountered at a similar distance. However, as shown in the groundwater modeling section (below), the capture area of pumping the well would be skewed in the upgradient direction of flow, and thus extend some distance upstream and may not be affected by a bedrock (no flow) boundary, nor directly draw from Stevens Creek at the given well yield. In support of this concept of drawing groundwater from the gravels closer to Stevens Creek, specific conductance of the pumped water was slightly higher than of Stevens Creek at the beginning of the pumping test, and progressively lowered to a similar reading by the end of pumping. It is likely that a much longer pumping period may show some creek recharge from pumping the well, given the reasonable assumption that gravel deposits beneath the site are connected to the creek and are recharged by it.

4.3 Water quality

A water sample was collected from the pumped well 2014-1 and from Stevens Creek on February 21, 2014 (following well development) and send to Soil Control Laboratory for analysis of general minerals and "Title 22" inorganics (**Table 2**). The general minerals were plotted in a Piper Diagram (**Figure 4**), which illustrates the ionic composition of the water samples. Piper diagrams are a commonly-used method to characterize (or 'fingerprint') and compare water from different sources. Both samples plot in the identical position on the chart and had a similar quantity of dissolved solids. This indicates a common source and supports the reasoning that the creek and alluvial gravels beneath the site are connected. The water is characterized as hard bicarbonate water with both calcium and magnesium, a type of groundwater common to Santa Clara County. The well water, however differs from the creek water in its concentrations of iron and manganese – each elevated above their respective MCL – whereas in Stevens Creek, they were not detected. It is fairly common to have iron and manganese in Bay Area groundwater. Their source in well 2014-1 may be related to oxidation of freshly drilled bedrock or to the oxidation of on-site fill. The slightly elevated concentrations of aluminum point toward the effects of freshly-drilled bedrock. Laboratory results otherwise met all of the primary and secondary drinking water limits listed in California Administrative Code, Title 22.

Boron is an important element for irrigation and agriculture. Small amounts are essential to plant growth, but greater concentrations of boron in irrigation water and build up in soils are harmful for some plants with toxic concentrations are as low as 1 milligrams per liter (mg/L) (Hem, 1985). Boron concentrations measured 0.32 mg/L, a safe level to be used for irrigation.

5 GROUNDWATER MODELING

Groundwater flow modeling was conducted for the area where alluvium and groundwater were found on site, as characterized in the geotechnical report (ENGEO, 2013) and summarized above. The model region extended north beyond the pump-test well 2014-1, the two monitoring wells, borings B-2, B-3, 2-B1, and 2-B2, the proposed cut-off wall, and into the proposed area of excavation (**Figure 11**). It also included a representative area south of Stevens Creek. The objective of the modeling was to evaluate the effect of temporary excavation during construction of the proposed project on groundwater flow, and to flow in Stevens Creek. To address this objective, we prepared three MODFLOW[2] models: (1) existing baseflow conditions using water elevation as observed during the aquifer test; (2) excavated conditions without a cut-off wall; and (3) excavated conditions that included the cut-off wall.

The modeling was conducted using the graphical user interface software Visual MODFLOW Flex 2014.1. Parameters and assumptions for the Parkside Trails Groundwater Model (PTGWM) are listed in **Table 6**. Basic data used to build the models were taken from the logs of on-site borings, monitoring wells and test pits (ENGEO, 2014), and our log of the pumping well (**Figure 11**). The model domain comprises two layers: a lower gravel layer resting on bedrock, and an overlying layer composed of fine-grain alluvium and fill. The bedrock was assumed to be an impermeable base to the models. Groundwater was found in the gravel layer, and its aquifer parameters (transmissivity and storage coefficient) were assessed with the conducted pumping test (described above).

To construct the model domain, three surfaces were used: ground surface, top of gravels, and bedrock contact (**Figure 12**). The ground surface was based on the USGS digital elevation model (dem) matched to the site topographic survey. The top of gravel surface was based on ENGEO’s boring and monitoring logs, Balance’s pumping-well log, and the location of Stevens Creek, The bedrock surface was similarly based

---

[2] MODFLOW is the USGS's three-dimensional (3D) finite-difference groundwater model. MODFLOW is considered an international standard for simulating and predicting groundwater conditions and groundwater/surface-water interactions. http://water.usgs.gov/ogw/modflow/

the logs of boring and wells on site, and on an assumed thickness of 10 feet below Stevens Creek. Gravel and bedrock elevations south of Stevens Creek were estimated based on conditions found on site. **Figure 13** illustrates the location of the model domain relative to the site topography, and boundary conditions are shown in **Figure 14** and listed in **Table 6**. The existing condition model was calibrated with (a) the highest hydraulic conductivity result from the pumping test, and (b) selecting upgradient and downgradient constant-head boundaries to reasonably match observed static water levels on site.

Results of the three models are illustrated in groundwater contour maps for Layer 2, one for each model. Overlying Layer 1 was generally dry. Groundwater contours are lines of equal hydraulic heads that can be thought of as a groundwater topography. Groundwater flow is – by definition -- perpendicular to the contours and is illustrated in each map with four particle tracks starting equally spaced at the upgradient boundary condition. Results for the existing conditions model (**Figure 15**), identifies groundwater flowing from the upgradient boundary to the downgradient boundary, along the flow path of Stevens Creek. A relatively small portion of groundwater is shown to flow around a broad bend to the north, eastward though the gravels characterized on site, and then south to the downgradient boundary. This relatively long flow path likely explains why we did not encounter a bedrock boundary, nor did we observe recharge from Stevens Creek during our pumping test. The capture zone of pumping well 2014-1 would extend upgradient in the direction of the particle track, and likely run parallel to Stevens Creek for some distance upstream, drawing water from the alluvium but not directly from Stevens Creek.[3]

Results for the excavated conditions model (**Figure 16**), show groundwater flowing to the excavated area because the bedrock contact is at a lower elevation than the downgradient boundary condition. If not mitigated or offset, this condition means that flow in the lower portion of Stevens Creek would be depleted during the de-watering period. However, after adding the proposed cut-off wall across the excavated

---

[3] It is reasonable to assume that Stevens Creek recharges the alluvium, and this is an assumption to the constructed models (Table 6).

boundary (**Figure 17**), groundwater flow resembles results of the existing conditions model (**Figure 15**), which suggests that pumping after a properly-constructed cutoff wall has been built would have little or no effect on flows in Stevens Creek.[4]

[4] We note that the grid cell dimension is 5 x 5 ft (Table 6), which is likely about twice as large as the typical cut-off wall width.

6 CONCLUSIONS

The Parkside Trails project proposes below-grade earthwork, excavation and re-engineered fill. The corrective grading plan for the project proposes a groundwater cut-off wall and possible temporary shoring elements where the excavation is below the groundwater elevation to limit groundwater flow into the area of excavation. To address potential effects on flow in Stevens Creek during construction dewatering, we utilized an approach that considers independent lines of reasoning – physical, chemical, and modeling – to evaluate existing groundwater conditions at the site. We also calibrated and used the developed model to simulate whether excavated conditions with a cut-off wall would mitigate effects of pumping on creek flows and groundwater along the stream.

After reviewing published geologic maps of the region, logs of on-site borings and test pits, and field geologic mapping of the site, we installed a well on site and conducted a pumping test to evaluate the aquifer parameters of alluvial gravels overlying Santa Clara Formation bedrock. Groundwater was found in the alluvial gravels, while the overlying finer-grained alluvium and non-engineered fill was unsaturated. The on-site gravels are also located in a bowl-shaped cut-bank erosional feature at a depth similar to Stevens Creek. Chemical analyses in the well and stream are virtually identical, supporting the physical reasoning that groundwater in the on-site gravels is connected to the broader valley alluvium of Stevens Creek.

We found that the alluvial gravel aquifers had maintained water levels and had properties of an unconfined aquifer system. Transmissivities measured with the constant-rate pumping test in one pumping well and a two monitoring wells ranged from 5,800 to 21,100 gallons per day per square foot (or a hydraulic conductivity of about 0.027 to 0.1 cm/sec). Measured specific yield (or storage coefficient) ranged measured 0.44 to 0.14.

Using results of the aquifer test and other published information, we developed a groundwater flow model for the three conditions:

- Existing site conditions,
- Excavated, without mitigation, and
- Excavated with a cut-off wall.

Results of modeling existing conditions concur with (or help explain) the pumping-test finding that no bedrock boundary or recharge from Stevens Creek was observed during 50 hours of pumping at 8.8 gallons per minute. A relatively small portion of groundwater is shown to flow around a broad bend to the north, eastward through the gravels characterized on site, and then back south towards Stevens Creek. Groundwater capture from the pumping well would tend to follow this long flow path that parallels the creek for some distance upstream rather than developing a theoretical cone of depression around the pumping well.

Modeling excavated conditions shows groundwater flowing to the excavated area, potentially depleting flows in Stevens Creek, while modeling excavated conditions with the addition of a proposed cut-off wall, shows groundwater flow to be very similar to existing conditions. Therefore, results of groundwater modeling suggest that proposed excavation with a properly constructed cut-off wall would limit flow to the excavated area from the broader alluvial aquifer and not discernibly affect baseflow in Stevens Creek at a significant level. A properly constructed cut-off wall would likely also contain project dewatering to the excavated area rather than drawing groundwater from the stream or riparian corridor along an upgradient flow path, as we interpreted the pumping test did.

7 LIMITATIONS

This report was prepared in general accordance with the accepted standard of practice existing in Northern California at the time the investigation was performed. No other warranties, expressed or implied, are made.

It should be recognized that interpretation and evaluation of subsurface conditions is a difficult and inexact art. Judgment leading to conclusions and recommendations presented above were partially based on existing information and personal communications during a very dry season, which in total represent an incomplete picture of the site. More extensive studies, including additional wells and monitoring, can substantially reduce some of the uncertainties associated with this study. If the client wishes to reduce the uncertainty beyond the level associated with this study, Balance should be notified for additional consultation.

Balance Hydrologics has prepared this report for the client's exclusive use on this particular project. The report is based in large part on work performed by experts and contractors in related fields, information provided by the client, and upon hydrogeologic reference values commonly used in the area or developed by sources generally held to be reliable, such as geologic and isohyetal maps. We have not independently verified their validity, accuracy or representativeness to this or other sites. If readers are aware of additional data, observations, conditions, or forthcoming changes to the bases of our decisions, please let us know at the first opportunity, such that this report may be revised.

8 REFERENCES

Brabb, E.E., Graymer, R.W., Jones, D.L., 2000, Geologic map and map database of the Palo Alto 30′ x 60′ Quadrangle, California: U.S. Geological Survey Miscellaneous Field Studies Map MF 2332.

California Department of Water Resources, 1974, Evaluation of ground water resources: Livermore and Sunol Valleys: Department of Water Resources Bulletin No. 118-2, 153 p.

Cooper, H.H, and Jacob, C.E., 1946, A generalized graphical method for evaluating formation constants and summarizing well field history: Amer. Geophys. Union Trans., vol. 27, pp. 526-534.

Dames and Moore, 1999, Site restoration report, McDonald Dorsa Property, Cupertino, California. November 22, 1999.

Driscoll, F.G., 1986, Groundwater and wells: second edition, Published by Johnson Filtration Systems, Inc. St. Paul, Minnesota, 1089 p.

ENGEO, 2013, Geotechnical report, Parkside Trails, Cupertino, California: Consulting report prepared for Ms. Bridgit Koller, Standard Pacific Homes, 3825 Hopyard Road, Suite 275, Pleasanton, CA 94588, revised November 13, 2013, 46 p. + appendices

Hem, J.D., 1985, Study and interpretation of chemical characteristics of natural waters: U.S. Geological Survey Water-Supply Paper 2254, 264 p.

Hitchcock, C.S., Kelson, K. I., Thompson, S. C., 1994, Geomorphic investigations of deformation along the northeastern margin of the Santa Cruz Mountains: USGS Open-File Report 94-187. March 1994.

Sorg, D.H., and McLaughlin, R.J., 1975, Geologic map of the Sargent-Berrocal fault zone between Los Gatos and Los Altos Hills, Santa Clara County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-643, scale 1:24,000.

Theis, C.V., 1935, The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage: Trans. Amer. Geophys. Union, 2, pp. 519-524.

A report prepared for:

April 10, 2014

Standard Pacific Homes
3825 Hopyard Road, Suite 275
Pleasanton, CA 94588
(925) 730-1339
Attention: Ms. Bridgit Koller
bkoller@stanpac.com

by

Mark Woyshner, MScEng
Senior Hydrogeologist/Director

Gustavo Porras
Hydrologist

Barry Hecht, CEG, CHg
Senior Principal

REGISTERED GEOLOGIST
BARRY HECHT
NO. 50
CERTIFIED
HYDROGEOLOGIST
STATE OF CALIFORNIA

Balance Hydrologics, Inc.®

800 Bancroft Way, Suite 101 ~ Berkeley, California 94710-2800 ~ (510) 704-1000 ~ office@balancehydro.com

TABLES

Table 1. Well location and construction specifications
Parkside Trails Project, City of Cupertino, California

		Well 2014-1 (pumped)	MW-1	MW-2
Distance from well 2014-1	*(feet)*	---	19.0	40.4
Latitude	*(WGS84)*	37°18'26.25"N	37°18'26.07"N	37°18'25.86"N
Longitude	*(WGS84)*	122° 4'9.85"W	122° 4'9.80"W	122° 4'9.75"W
RP Elevation	*(feet, NGVD29)*	413.22	409.60	408.55
Stick up	*(feet)*	2.7	-0.4	-0.4
Total depth	*(feet bgs)*	60.0	46.0	46.0
Screen interval	*(feet bgs)*	40.0 to 60.0	29.0 to 44.0	30.0 to 45.0
Depth of seal	*(feet bgs)*	38.0	28.0	29.0
Completion date		2/18/2014	2/4/2014	1/31/2014
Static water level on 3/17/14	*(feet bgs)*	39.6	39.0	37.9
Depth to top of alluvium (Qal)	*(feet bgs)*	23.0	28.0	28.0
Depth to top of gravels (Qal)	*(feet bgs)*	42.0	34.0	37.0
Depth to bedrock (QTsc)	*(feet bgs)*	50.0	---	43.0

Notes:

1. Split spoon samples were collected while drilling MW-1 and MW-2, characterizing sediments and depths more accurately than with samples of cuttings while drilling pumping well 2014-1.
2. RP = Reference Point (north tangent of wells' top of casing). Elevation established from relative survey of the three wells using the ground surface at MW-1 (410 ft) as the bench mark.
3. bgs = below ground surface

Table 2. Summary results of water quality analyses of samples collected following installation and development of well 2014-1 Parkside Trails, City of Cupertino, California

PARAMETER	UNITS	DETECTION LIMIT	MCL	Well 2014-1	Stevens Creek
DESCRIPTORS					
Sample I.D.				4020586-02	4020586-01
Latitude, WGS84	degrees			37°18'26.25"N	37°18'24.69"N
Longitude, WGS84	degrees			122° 4'9.85"W	122° 4'8.98"W
Elevation, WGS84	feet			410.56	374
Lab used				Soil Control	Soil Control
Sample collected by				G. Porras	G. Porras
FIELD MEASUREMENTS					
Date	MM/DD/YY			2/21/14	2/21/14
Time	HH:MM			13:45	13:30
Specific conductance (@ 25 C°)	umhos/cm			693	775
Conductance (@ field temp)	umhos/cm			571	587
Temperature	deg C			16.2	12.4
WATER QUALITY INDICATORS					
Alkalinity (total)	mg/L CaCO3	2		320	370
Hardness (total)	mg/L CaCO3	5		350	410
pH	pH Units	0.1	10.6	7.1	7.9
Specific conductance (@ 25 C°)	umhos/cm	1	1600	750	830
Total dissolved solids (TDS)	mg/L	10	1000	430	480
MBAS (surfactants)	mg/L	0.025	0.5	0	0
GENERAL PHYSICAL					
Color	Color Units	3		0	0
Threshold Odor No.	T.O.N.	1		0	0
Turbidity	NTU	0.1		0	0
GENERAL MINERALS					
Bicarbonate (as CaCO3)	mg/L	2		320	369
Bicarbonate (as HCO3)	mg/L	2		390	450
Calcium (Ca)	mg/L	0.5		87	97
Carbonate (as CaCO3)	mg/L	3		0	0
Carbonate (as CO3)	mg/L	2		0	0
Chloride (Cl)	mg/L	1	500	31	32
Magnesium (Mg)	mg/L	0.5		33	39
Potassium (K)	mg/L	0.5		1.9	2.3
Sodium (Na)	mg/L	0.5		29	30
Sulfate (SO4)	mg/L	1	500	52	59
Major Cations (Ca+Mg+K+Na)	meq/L	--	--	8.37	9.41
Major Anions (HCO3+CO3+Cl+SO4)	meq/L	--	--	8.35	9.51
Ion Balance (Cations/Anions)	--	--	--	1.00	0.99

PARAMETER	UNITS	DETECTION LIMIT	MCL	Well 2014-1	Stevens Creek
TITLE 22 PRIMARY STANDARDS, INORGANIC					
Aluminum (Al)	ug/L	0.05	1	670	0
Antimony (Sb)	ug/L	6	6	0	0
Arsenic (As)	ug/L	2	10	0	2.3
Barium (Ba)	ug/L	100	1000	200	180
Beryllium (Be)	ug/L	1	4	0	0
Cadmium (Cd)	ug/L	1	5	0	0
Chromium (Cr)	ug/L	1	50	3.2	0
Copper (Cu)	ug/L	50	1000	0	0
Cyanide (CN)	ug/L	100	200	0	0
Fluoride (F)	mg/L	0.1	2	0.17	0.17
Lead (Pb)	ug/L	5	15	0	0
Mercury (Hg)	ug/L	1	2	0	0
Nickel (Ni)	ug/L	10	100	0	0
Nitrate (as NO3)	mg/L	1	45	0	0
Nitrate + Nitrite (as N)	mg/L	0.1	10	0	0.13
Nitrite (as N)	mg/L	0.1	1		
Selenium (Se)	ug/L	5	50	0	0
Thallium (Tl)	ug/L	1	2	0	0
TITLE 22 SECONDARY STANDARDS, INORGANIC					
Iron (Fe)	ug/L	50	300	**960**	0
Manganese (Mn)	ug/L	20	50	**510**	0
Sliver (Ag)	ug/L	0.01	10	0	0
Zinc (Zn)	ug/L	50	5000	0	0
OTHER CONSTITUENTS					
Boron (B)	mg/L	0.1		0.32	0.32

NOTES

Lab results: 0 = not detected; blank value = not tested

MCL = Title 22 Maximum Contaminant Level as of June 12, 2003; the MCL of Lead is the Regulatory Action Level

Bold red font indicates a laboratory result exceeding its MCL.

Table 3. Field water-quality measurements during aquifer testing, Parkside Trails Project, City of Cupertino, California

Location	Date/Time *PDT*	Flow Rate *gpm*	Volume Pumped *gallons*	pH	Turbidity *NTUs*	Water Temperature *°C*	Specific Conductance at field temperature *µmhos/cm*	Specific Conductance at 25 °C *µmhos/cm*	Remarks
Well 2014-1	3/18/14 13:23	7.8	---	---	0.55	15.4	660	810	Step test conducted
	3/19/14 12:00	8.8	922	7.05	0.27	15.9	664	810	Begin 51.5-hour pumping test at 10:15
	3/20/14 11:45	8.8	13,428	7.07	0.01	16.9	681	805	After 25.5 hours of pumping at 8.8 gallons per minute
	3/21/14 12:50	8.6	26,426	7.19	0.03	16.5	661	789	End of pumping at 13:45
Stevens Creek	3/18/14 13:23	224	---	---	7.19	12.9	603	784	During step test
	3/19/14 12:00	224	---	8.05	8.33	11.2	545	740	During pumping test
	3/20/14 11:45	224	---	8.01	12.11	14.3	631	793	During pumping test
	3/21/14 12:50	224	---	7.93	10.73	15	635	785	During pumping test

Table 4. Summary of aquifer parameter calculations
Parkside Trails, City of Cupertino, California.

50-hour pumping test (March 19 to 21, 2013)	**Well 2014-1** (pumped well)	**MW-1** (observation well)	**MW-2** (observation well)
Drawdown slope, s	0.40	0.23	0.18
Pumping rate, Q (gpm)	8.8	8.8	8.8
Diameter (inches)	6	2	2
Total depth (feet bgs)	60	46	46
Transmissivity, T (gpd/ft)	5808	10101	12907
Aquifer thickness, b (ft) [1]	10	10	10
Hydraulic conductivity, K (gpd/ft^2)	581	1010	1291
Hydraulic conductivity, K (cm/s)	2.7E-02	4.8E-02	6.1E-02
Time of zero drawdown, t_o (minutes)	--	75	85
Distance from pumped well, r (feet)	--	19	40
Storage coefficient, S	--	0.437	0.143

Recovery test (residual drawdown)	**Well 2014-1** (pumped well)	**MW-1** (observation well)	**MW-2** (observation well)
Drawdown slope, s	0.200	0.375	0.300
Pumping rate, Q (gpm)	8.8	8.8	8.8
Transmissivity, T (gpd/ft)	11616	6195	7744
Aquifer thickness, b (ft) [1]	10	10	10
Hydraulic conductivity, K (gpd/ft^2)	1162	620	774
Hydraulic conductivity, K (cm/s)	5.5E-02	2.9E-02	3.7E-02

Notes:

1. Aquifer thickness, b = bedrock depth - static water level = 50 - 40 = 10 feet

2. Method assumes (1) full penetration of the aquifer, and perhaps more importantly, (2) the hydraulic conductivity ("permeability") is similar across the aquifer (homogeneous conditions), and (3) the hydraulic conductivity is the same in all directions (isotropic conditions). Although the assumptions are never strictly met in any natural aquifer system, they are commonly suitable to roughly estimate bulk aquifer properties. Results seem reasonable despite the geologic differences.

Table 5. Estimated radius of influence with 50 hours of pumping well 2014-1 at 8.8 gallons per minute, Parkside Trails, City of Cupertino, California.

Case A. Average transmissivity measured *(time-drawdown method)*

Given:	Transmissivity, T	9000 gpd/ft	1203 ft^2/day
	Storativity, S	0.3	
	Pumping rate, Q	8.8 gpm	0.02 cfs
	Pumping duration, t	2.1 days	50 hours
Find: drawdown, s(r,t)			

Distance from well r (ft)	$u=(1.87*r^2*S)/(T*t)$	W(u)	Drawdown s max (ft) = (264*Q/T) * W(u)	
0.5	7.5E-06	4.88	**1.3**	radius of borehole
5	7.5E-04	2.88	**0.74**	
10	3.0E-03	2.27	**0.59**	
50	7.5E-02	0.88	**0.23**	
100	3.0E-01	0.27	**0.07**	
120	4.3E-01	0.11	**0.03**	Stevens Creek

Case B. Maximum transmissivity measured *(distance-drawdown method)*

Given:	Transmissivity, T	21100 gpd/ft	2821 ft^2/day
	Storativity, S	0.3	
	Pumping rate, Q	8.8 gpm	0.02 cfs
	Pumping duration, t	2.1 days	50 hours
Find: drawdown, s(r,t)			

Distance from well r (ft)	$u=(1.87*r^2*S)/(T*t)$	W(u)	Drawdown s max (ft) = (264*Q/T) * W(u)	
0.5	3.2E-06	5.25	**1.4**	radius of well casing
5	3.2E-04	3.25	**0.84**	
10	1.3E-03	2.64	**0.68**	
50	3.2E-02	1.25	**0.32**	
100	1.3E-01	0.64	**0.17**	
120	1.8E-01	0.48	**0.13**	Stevens Creek

Method:

Theoretical drawdown was calculated using Cooper and Jacob modified nonequilibrium Theis equation (Driscoll, F.G., 1986, Groundwater and Wells, 2nd Ed., p. 219).

The modified nonequilibrium equation is valid for values of u less than about 0.05, otherwise values are approximate.

Theis' nonequilibrium equation is based on the following assumptions:

a) The water-bearing formation is uniform in character and the hydraulic conductivity is the same in all directions.
b) The formation is uniform in thickness and infinite in areal extent.
c) The formation receives no recharge from any source.
d) The pumped well penetrates, and receives water from, the full thickness of the water-bearing formation.
e) The water removed from storage is discharged instantaneously when the head is lowered.
f) The pumping well is 100 percent efficient.
g) All water removed from the well comes from aquifer storage.
f) Laminar flow exists throughout the well and aquifer.
i) The water table or potentiometric surface has no slope.

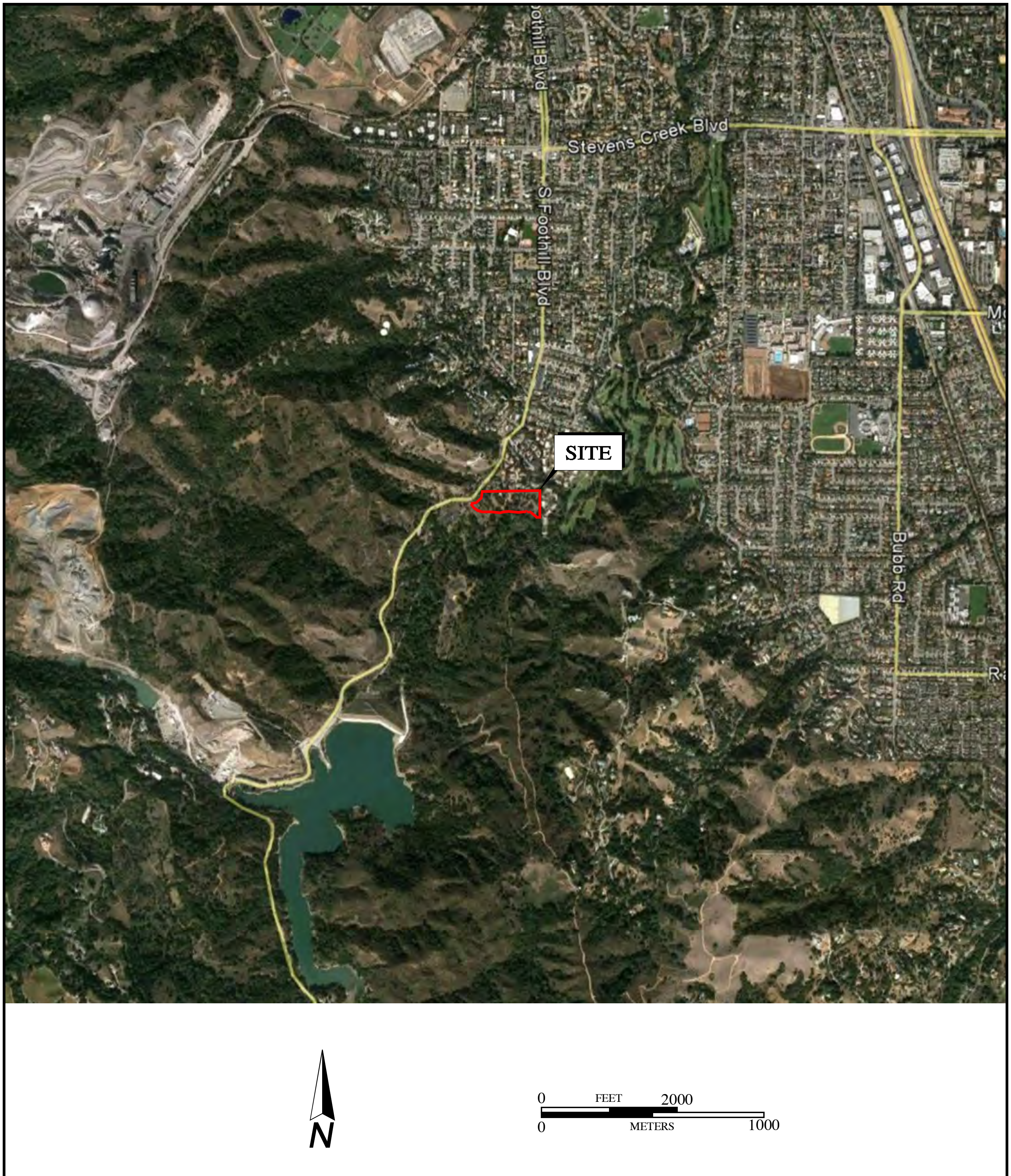
Notes:

1. The modified nonequilibrium equation is valid for values of u less than about 0.05, otherwise values are approximate.
2. Transmissivity (T) and storage coefficient (S) estimated from 50-hour constant-rate pumping test at 8.8 gpm and recovery results.

Table 6. Parkside Trails Groundwater Model parameters and assumptions, City of Cupertino, California.

	Model configuration existing conditions	Model configuration excavated conditions
Software		
MODFLOW version	MODFLOW-2005	MODFLOW-2005
Graphical User Interface	Visual MODFLOW Flex 2014.1 64 bit, Build 2.0.102.0	Visual MODFLOW Flex 2014.1 64 bit, Build 2.0.102.0
Model domain		
Rows, columns	72 x 68 cells	69 x 68 cells
Cell dimensions (R x C) ft	5 x 5 ft	5 x 5 ft
Layers	2	2
Total cells	4896	4692 (including inactive cells)
Grid type	Deformed	Deformed
Aquifer properties		
Zone 1: Hydraulic conductivity, K_{xy} (cm/s), Layer 1	1×10^{-1}	1×10^{-1}
Zone 1: Hydraulic conductivity, K_z (cm/s), Layer 1	1×10^{-2}	1×10^{-2}
Zone 2: Hydraulic conductivity, K_{xy} (cm/s), Layer 2	1×10^{-3}	1×10^{-3}
Zone 2: Hydraulic conductivity, K_z (cm/s), Layer 2	1×10^{-4}	1×10^{-4}
Zone 3: Hydraulic conductivity, K_{xy} (cm/s), Cut-off wall	none	1×10^{-5}
Zone 3: Hydraulic conductivity, K_z (cm/s), Cut-off wall	none	1×10^{-5}
Specific storage, Ss (1/m)	1×10^{-5}	1×10^{-5}
Specific yield, Sy	0.20	0.20
Effective porosity	0.14	0.14
Total porosity	0.30	0.30
Boundary conditions		
Upgradient, Layer 2	15 cells Constant Head fixed at 374 ft	15 cells Constant Head fixed at 374 ft
Downgradient, Layer 2	15 cells Constant Head fixed at 370 ft	15 cells Constant Head fixed at 370 ft
Excavated face, Layer 2	none	35 cells Constant Head fixed at bedrock elevation
Stevens Creek	Width = 10 ft, Depth = 1 ft, Elevation = gravel surface	Width = 10 ft, Depth = 1 ft, Elevation = gravel surface
River-bed conductivity (cm/s)	1×10^{-2}	1×10^{-2}
Stevens Creek stage	Bed elevation + 1 ft	Bed elevation + 1 ft
Simulation		
Stress periods	Steady state	Steady state
Time steps per stress period	Steady state	Steady state
Time step multiplier	Steady state	Steady state
Initial head values (ft)	374	374

FIGURES



BASE MAP SOURCE: GOOGLE EARTH PRO

ENGEO
Expect Excellence

VICINITY MAP
PARKSIDE TRAILS
CUPERTINO, CALIFORNIA

PROJECT NO.: 10014.000.000
SCALE: AS SHOWN
DRAWN BY: LL
CHECKED BY: PCG
FIGURE NO. 1

G:\Drafting\DRAFTING2_Dwg_10000 to 12999\10014\000\Final GEX\10014000000-GEX-1-VicinityMap-0713.dwg Plot Date: 11-11-13 llee

ORIGINAL FIGURE PRINTED IN COLOR

EXPLANATION

⌖	BALANCE HYDROLOGICS WELL
Qaf1	UNDOCUMENTED FILL
Qef	ENGINEERED FILL ASSOCIATED WITH CITY OF CUPERTINO UNREGISTERED LANDFILL RESTORATION
Qaf2	UNDOCUMENTED FILL ASSOCIATED WITH FORMER QUARRY HAUL ROAD
Qal	ALLUVIUM (HOLOCENE)
Qoal	OLDER ALLUVIAL DEPOSITS WITH HIGHER FINES CONTENT AND MORE DENSE THAN Qal
Qt	ALLUVIAL TERRACE DEPOSITS (PLEISTOCENE)
QTsc	SANTA CLARA FORMATION (SANDSTONE AND CONGLOMERATE)
2-B7 12'	APPROXIMATE LOCATION OF BORING, WITH DEPTH TO SANTA CLARA FORMATION SHOWN
B-3 29.5'	APPROXIMATE LOCATION OF TEST BORING, WITH DEPTH TO SANTA CLARA FORMATION SHOWN (ENGEO, JUNE 2013)
TP-20 5'	APPROXIMATE LOCATION OF TEST PIT, WITH DEPTH TO SANTA CLARA FORMATION SHOWN
48	STRIKE AND DIP OF BEDDING
45	STRIKE AND DIP OF BEDDING (EARTH SYSTEMS, 1985)
	GEOLOGIC CONTACT, DASHED WHERE APPROXIMATE AND DOTTED WHERE CONCEALED
	RIPARIAN CORRIDOR (LSA)
	APPROXIMATE FLOW LINE OF STEVENS CREEK (LSA)
6 6'	APPROXIMATE LOCATION OF CROSS SECTION
	APPROXIMATE LOCATION OF PROPOSED KEYWAY EXCAVATION (REPRESENTS BASE OF KEYWAY)
	APPROXIMATE LOCATION OF GROUNDWATER CUT OFF AND POSSIBLE TEMPORARY SHORING ELEMENTS
	APPROXIMATE LOCATION OF PROPOSED BELOW GRADE MSE WALL (HATCHING REPRESENTS APPROXIMATE AREA UNDERLAIN BY GEOGRID)
	APPROXIMATE LOCATION OF PROPOSED SUBEXCAVATION AREA

NOTE:

Qaf/Qal - UNDOCUMENTED FILL OVER HOLOCENE ALLUVIUM

Qt/Qtsc - TERRACE DEPOSITS OVER SANTA CLARA FORMATION

Qaf1/Qoal - UNDOCUMENTED FILL OVER OLDER ALLUVIUM

Qaf2/Qef - UNDOCUMENTED FILL OVER ENGINEERED FILL

N

0' 40' 80' 200'

SCALE: 1" = 40'

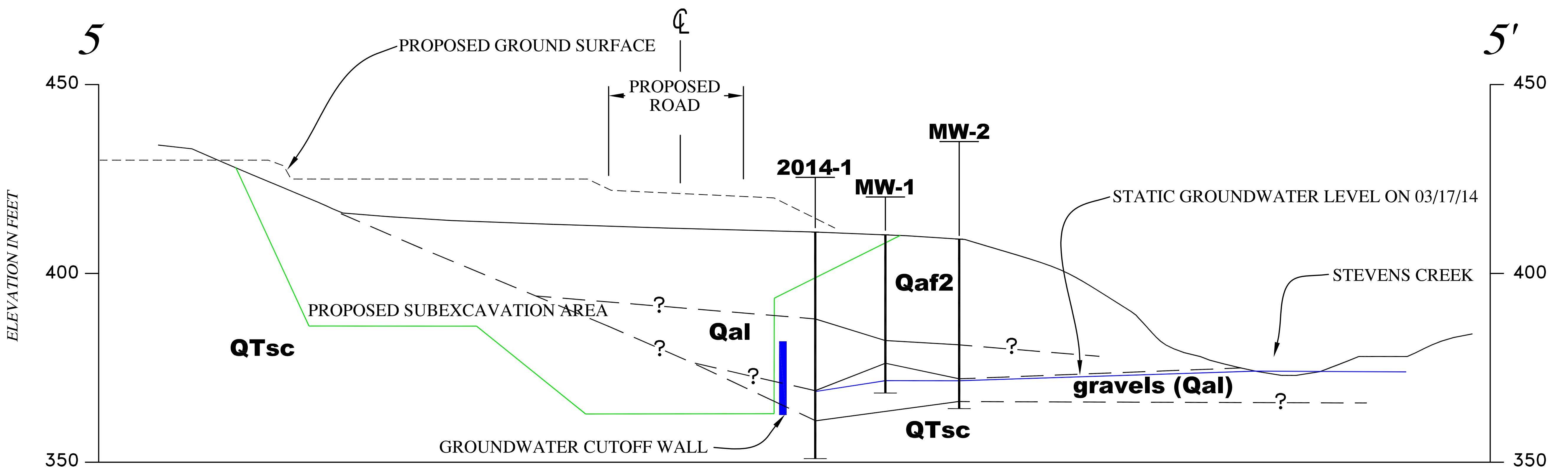
ENGEO Expect Excellence

PROJECT NO.: SCALE: DRAWN BY: CHECKED BY: FIGURE NO.

Balance Hydrologics, Inc.

Figure 2. Location of installed wells, Parkside Trails, City of Cupertino, California.

Note: This figure was taken from ENGEO and modified to include the Balance Hydrologics Wells.



EXPLANATION

Qaf2 UNDOCUMENTED FILL ASSOCIATED WITH FORMER QUARRY HAUL ROAD

QTsc SANTA CLARA FORMATION (SANDSTONE AND CONGLOMERATE)

Qal ALLUVIUM (HOLOCENE)

MW-1 APPROXIMATE LOCATION OF WELL

ENGEO
Expect Excellence

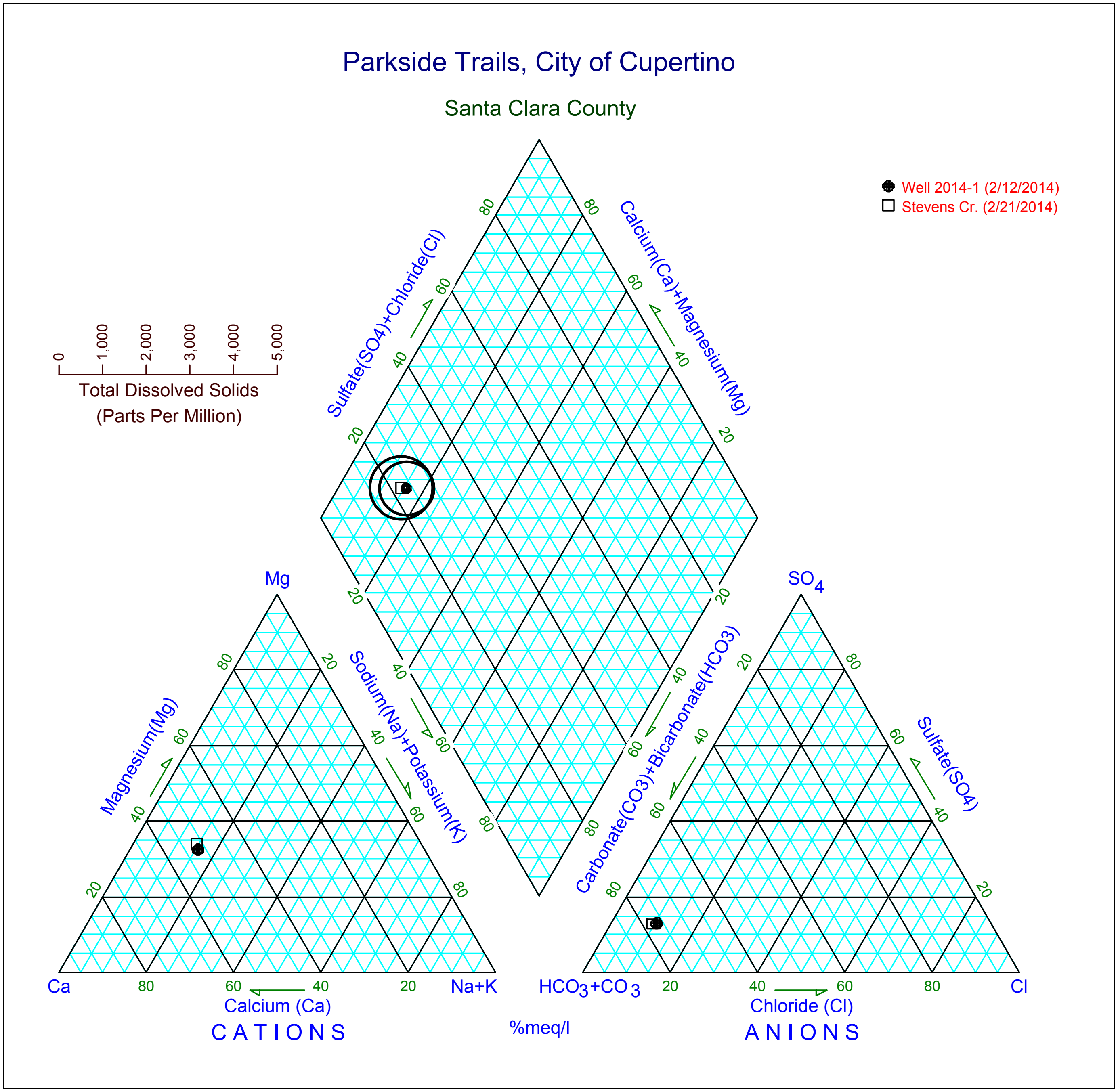
Balance Hydrologics, Inc.

Figure 3. Hydrogeologic cross-section 5-5', Parkside Trails, City of Cupertino, California.

Source of geologic cross section: ENGO, 2013.

0' 30' 60' 120'

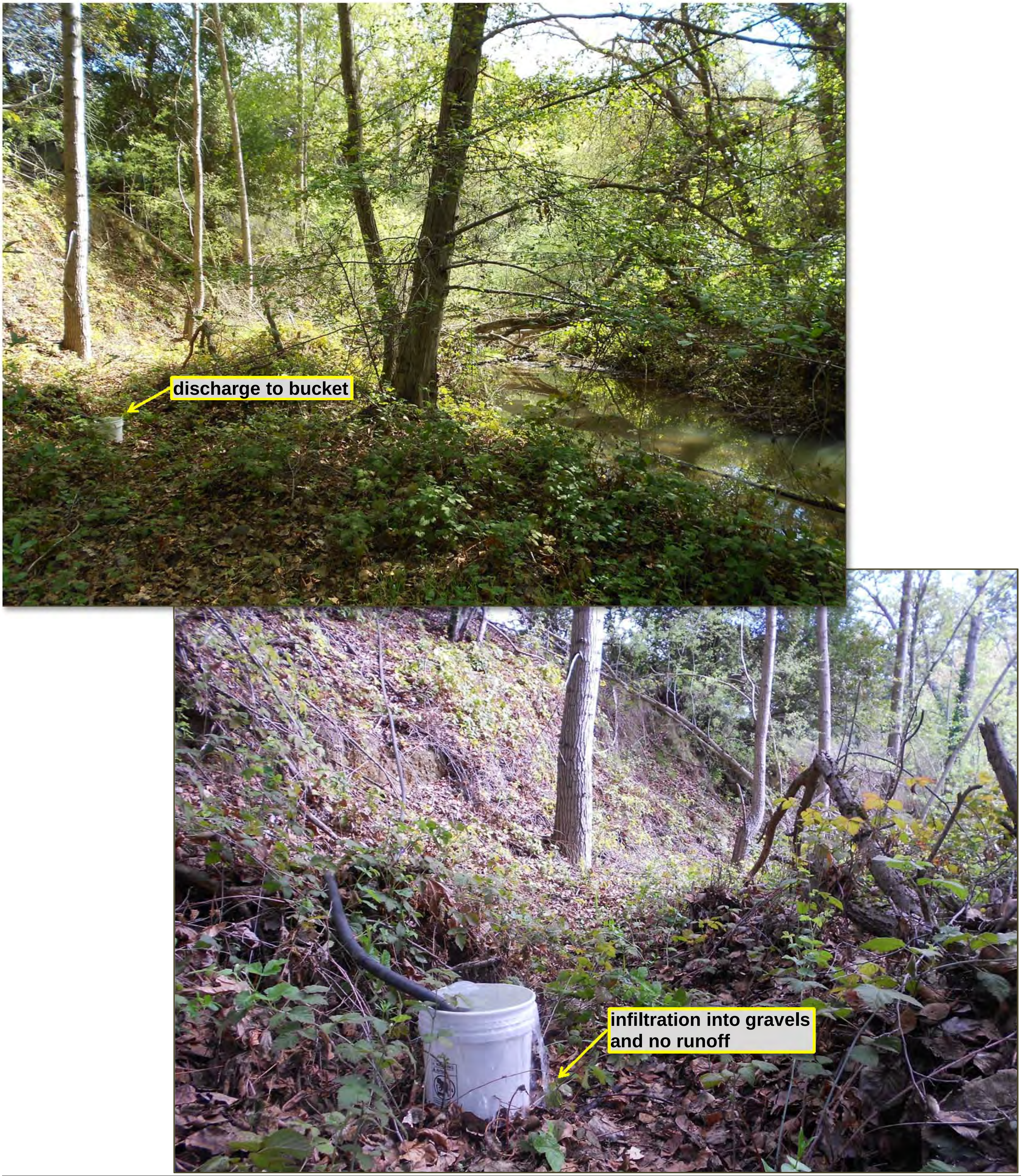
SCALE: 1" = 30'



This diagram shows cations in the ternary graph on the left and anions on the right graph. The diamond graph in the center illustrates both cations and anions. Hardness dominated water plots to the left and top of the diamond graph, soft monovalent-salt dominated water to the right, and soft alkaline water towards the bottom. The radius of circle around the plotted points represents the concentration of dissolved solids, calibrated to the scale shown.

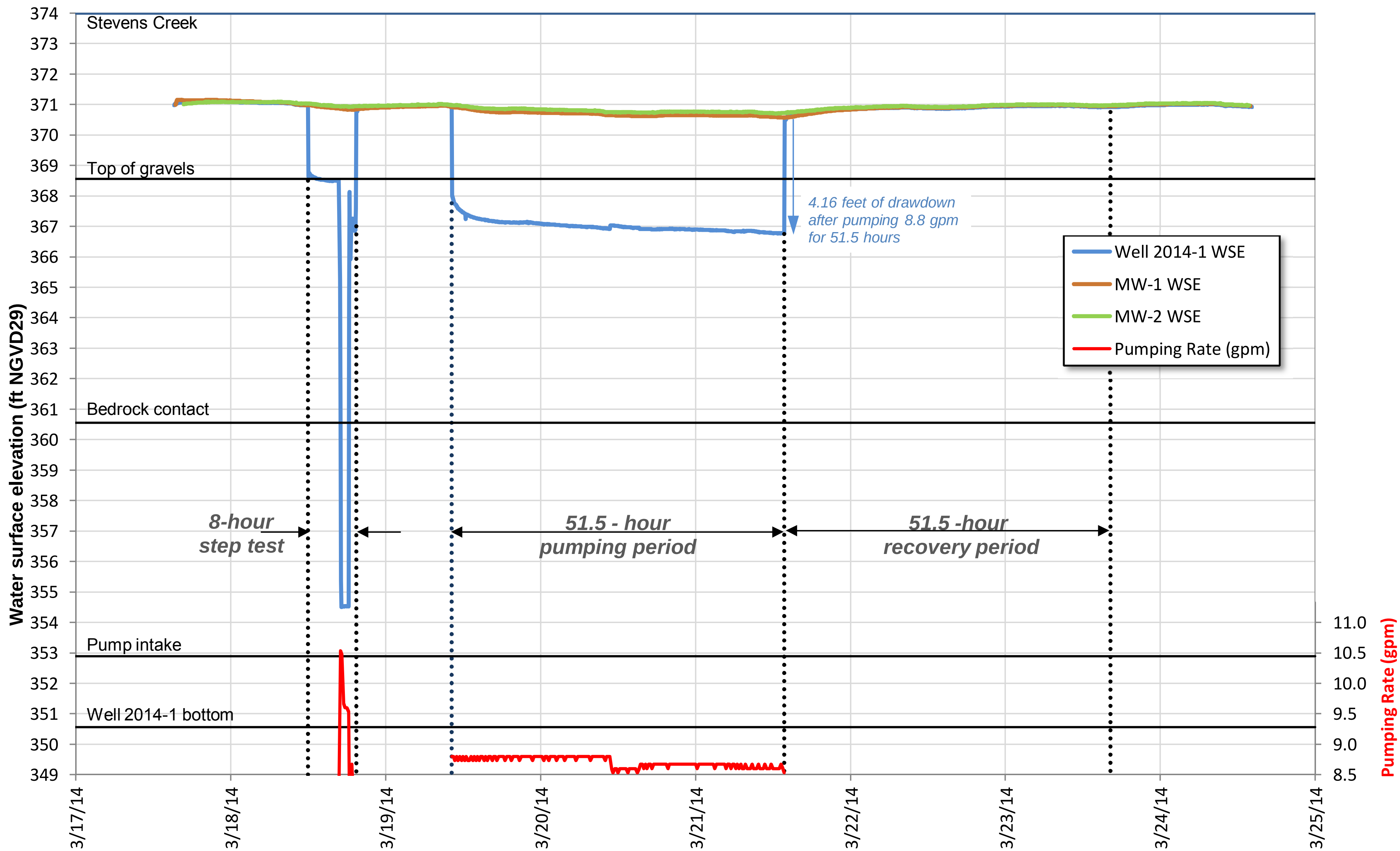
Balance Hydrologics, Inc.®

Figure 4. Piper diagram illustrating ionic signatures of water samples collected from Stevens Creek and at the Parkside Trails site following installation and development of well 2014-1, City of Cupertino, California.



Balance Hydrologics, Inc.®

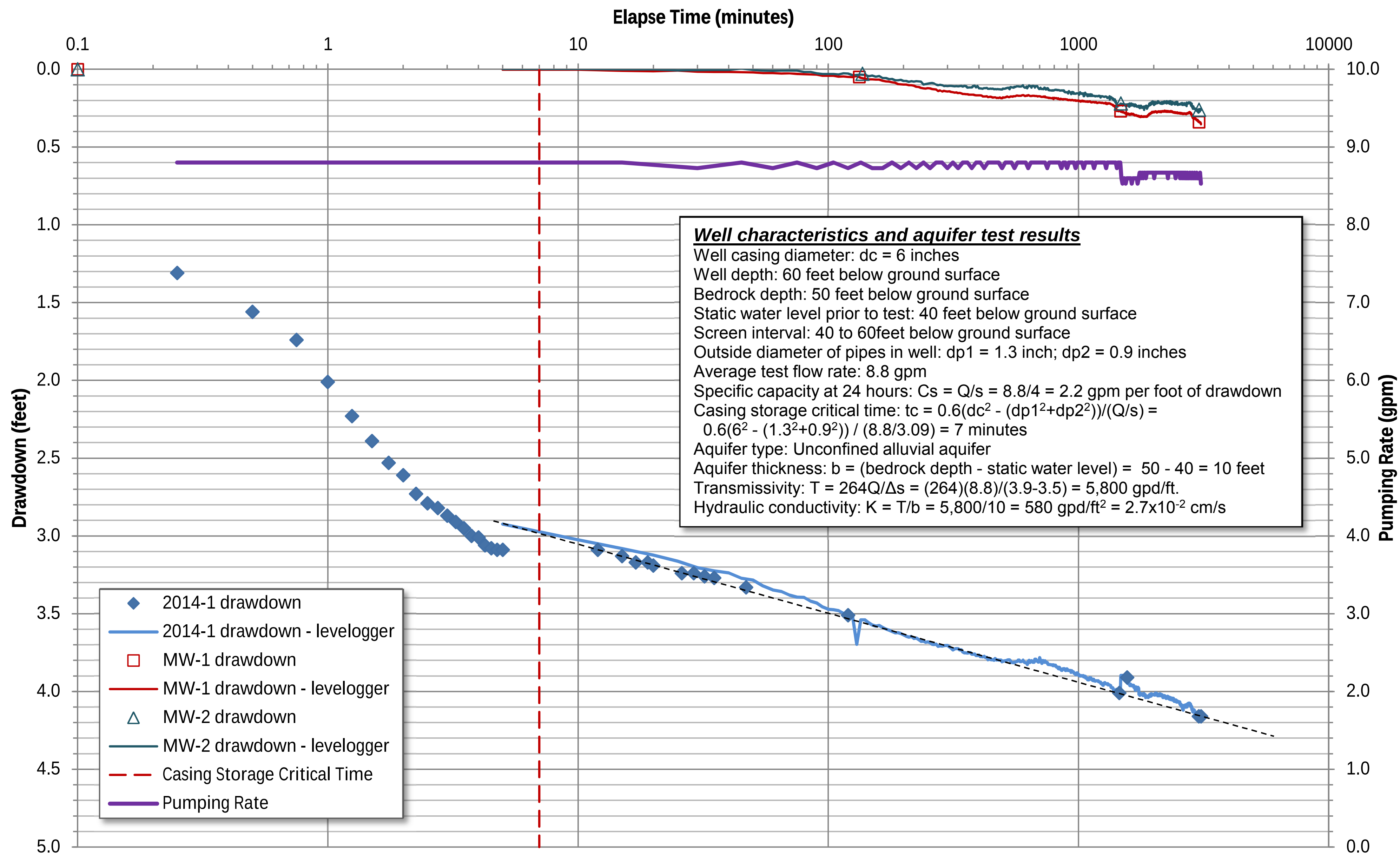
Figure 5. Photos of aquifer test discharge of 8.8 gallons per minute to Stevens Creek, Parkside Trails, City of Cupertino, California.
Stevens Creek is located about 120 feet from the pumping well 2014-1.



Balance Hydrologics, Inc.®

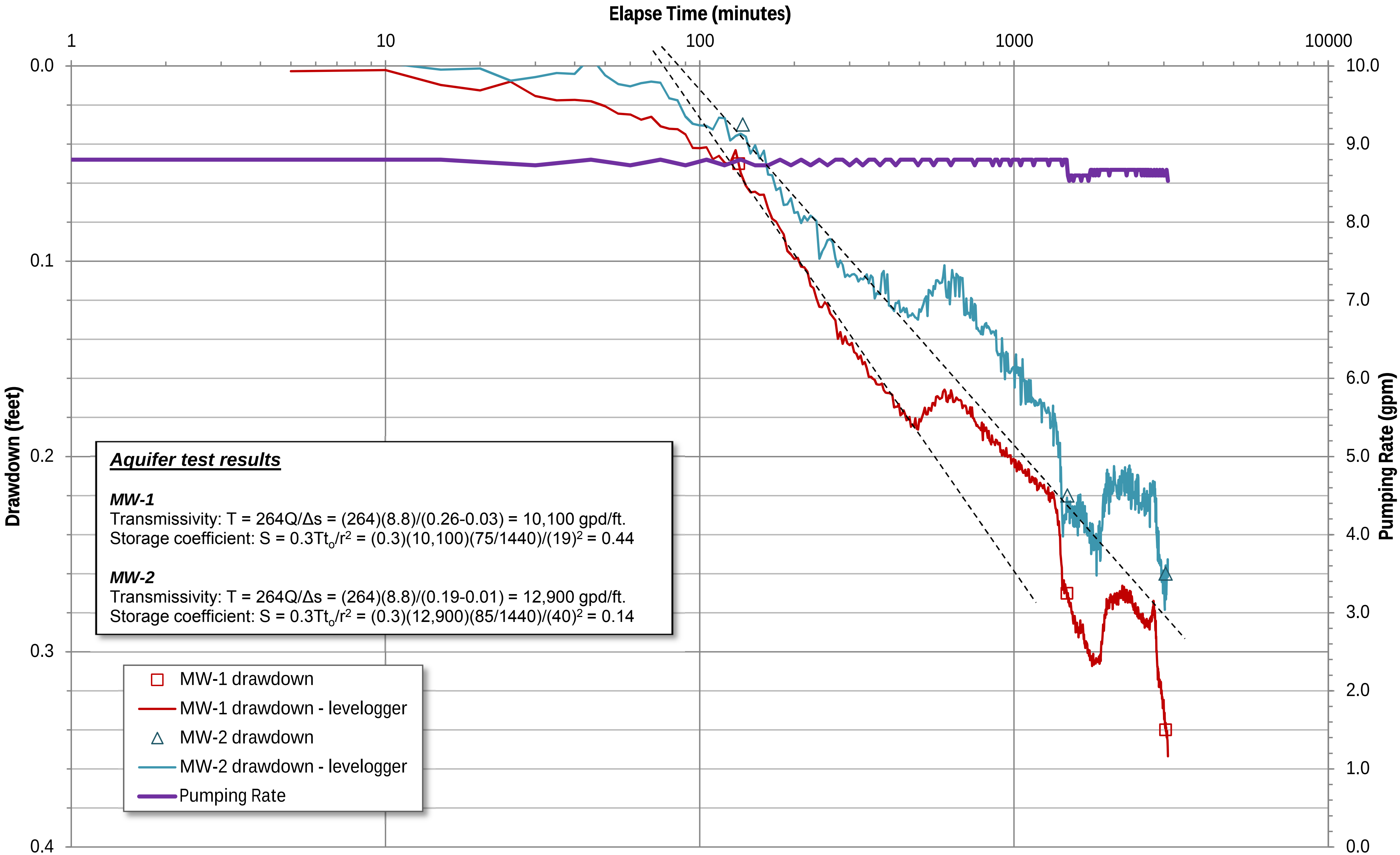
Figure 6. Water surface elevations during step test and aquifer test, Parkside Trails Project, City of Cupertino, California. The elevation of Stevens Creek is higher than groundwater elevations at the on-site wells, indicating a groundwater flow gradient from Stevens Creek to the area proposed for excavation. During the step test we noted cascading water in the well at pumping rates much greater than 9 gpm. The pumping test was conducted at a constant rate of 8.8 gallons per minute. After 51 hours of pumping, drawdown was 4.16 feet in the pumping well, 0.35 feet in MW-1 (19 ft from pumping), and 0.26 feet in MW-2 (40 ft from pumping).

213200A pump test_140402.xlsx, WSE chart



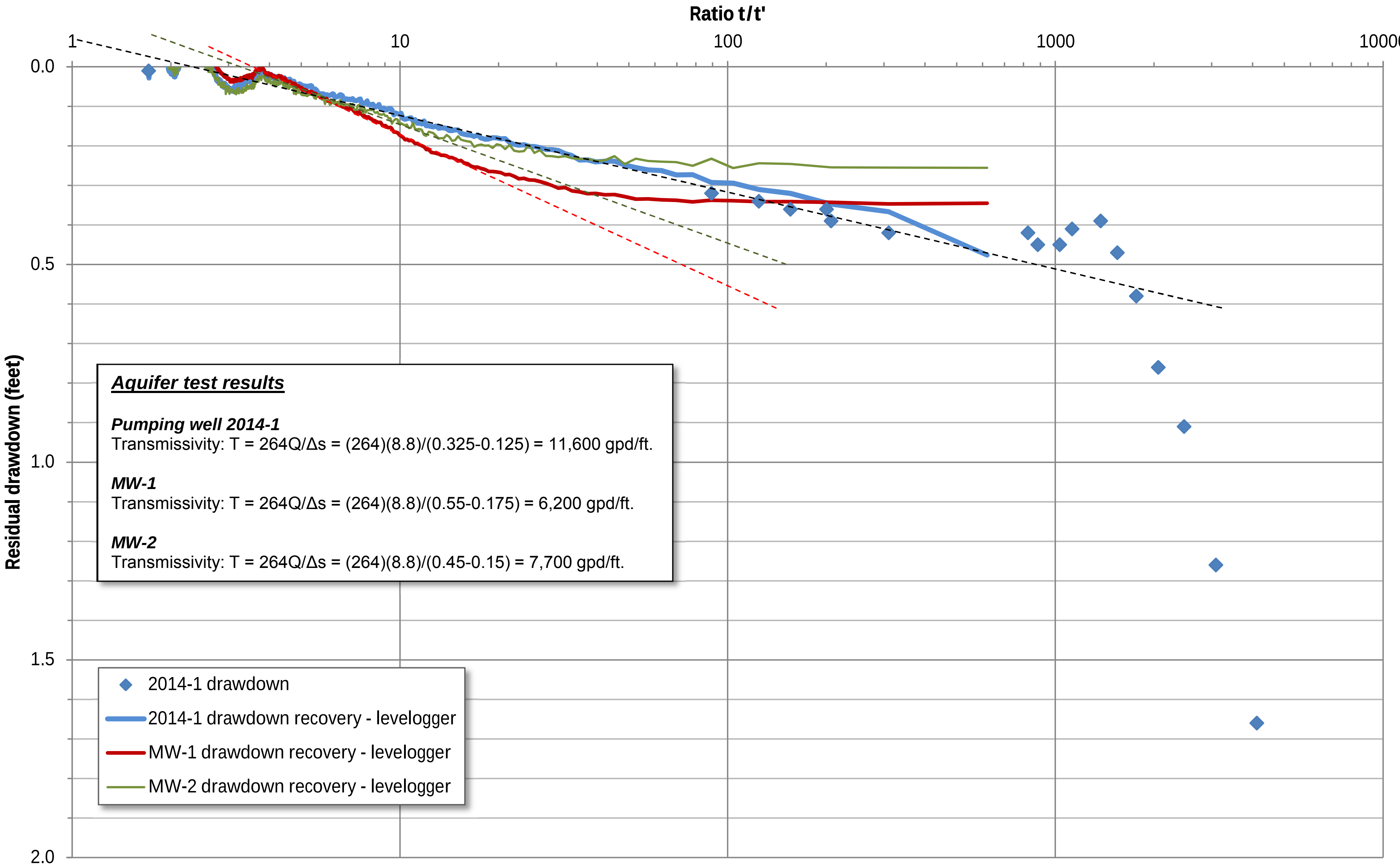
Balance Hydrologics, Inc.®

Figure 7. Water-level drawdown in pumped well 2014-1 and observation wells during constant-rate pumping test, Parkside Trails, City of Cupertino, California. The slope of the time-drawdown curve is used to calculate transmissivity (T) and was selected after the critical casing storage time.



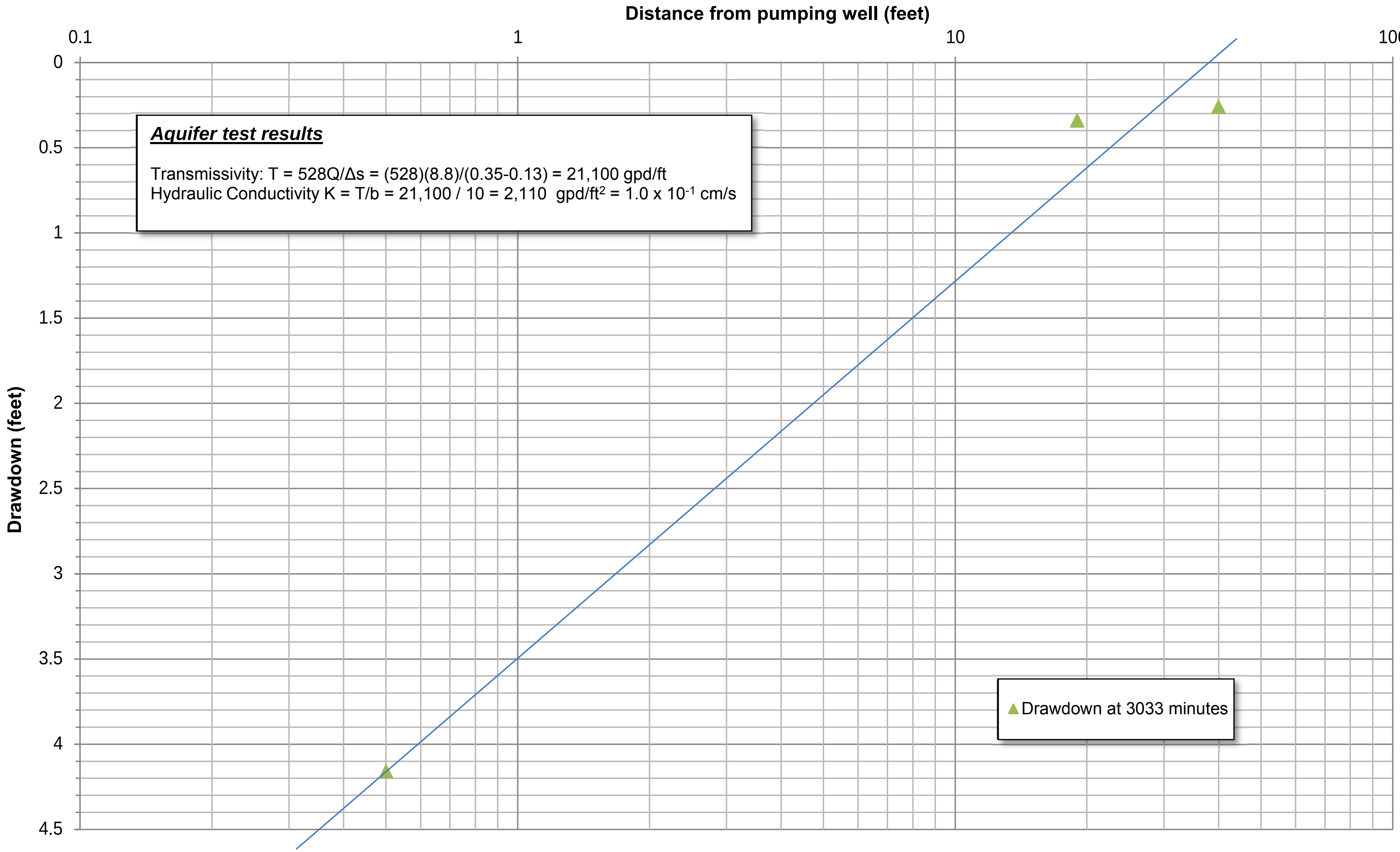
Balance Hydrologics, Inc.®

Figure 8. Water-level drawdown in observation wells affected by pumping well 2014-1 during constant-rate pumping test, Parkside Trails, City of Cupertino, California. The slope of the time-drawdown curve is used to calculate transmissivity (T) and the offset at zero drawdown is used to calculate storage coefficient (S).



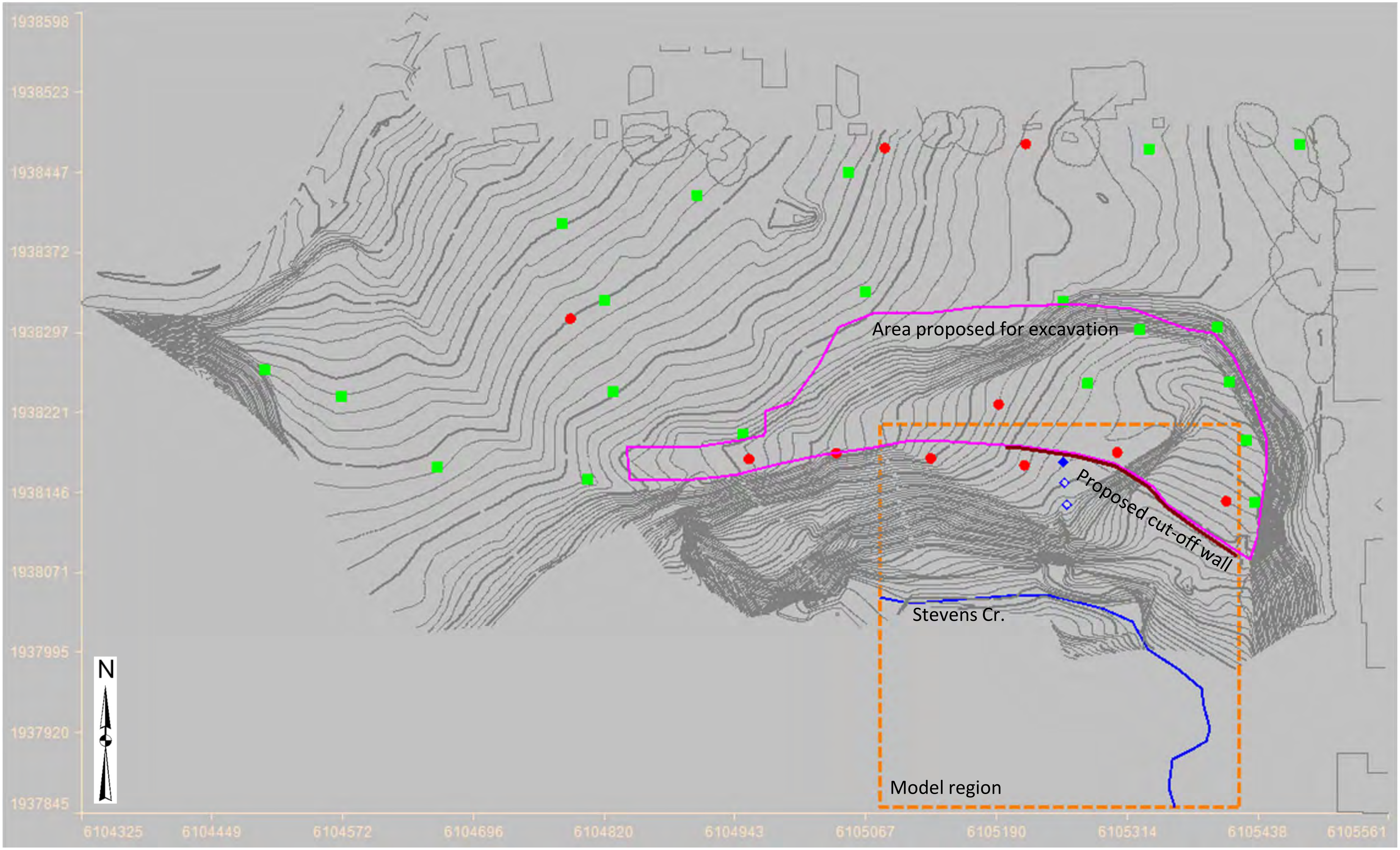
Balance Hydrologics, Inc.®

Figure 9. Drawdown recovery from constant rate pumping test ending March 21, 2014, Parkside Trails, City of Cupertino, California. The slope of the recovery curve is used to calculate transmissivity (T).



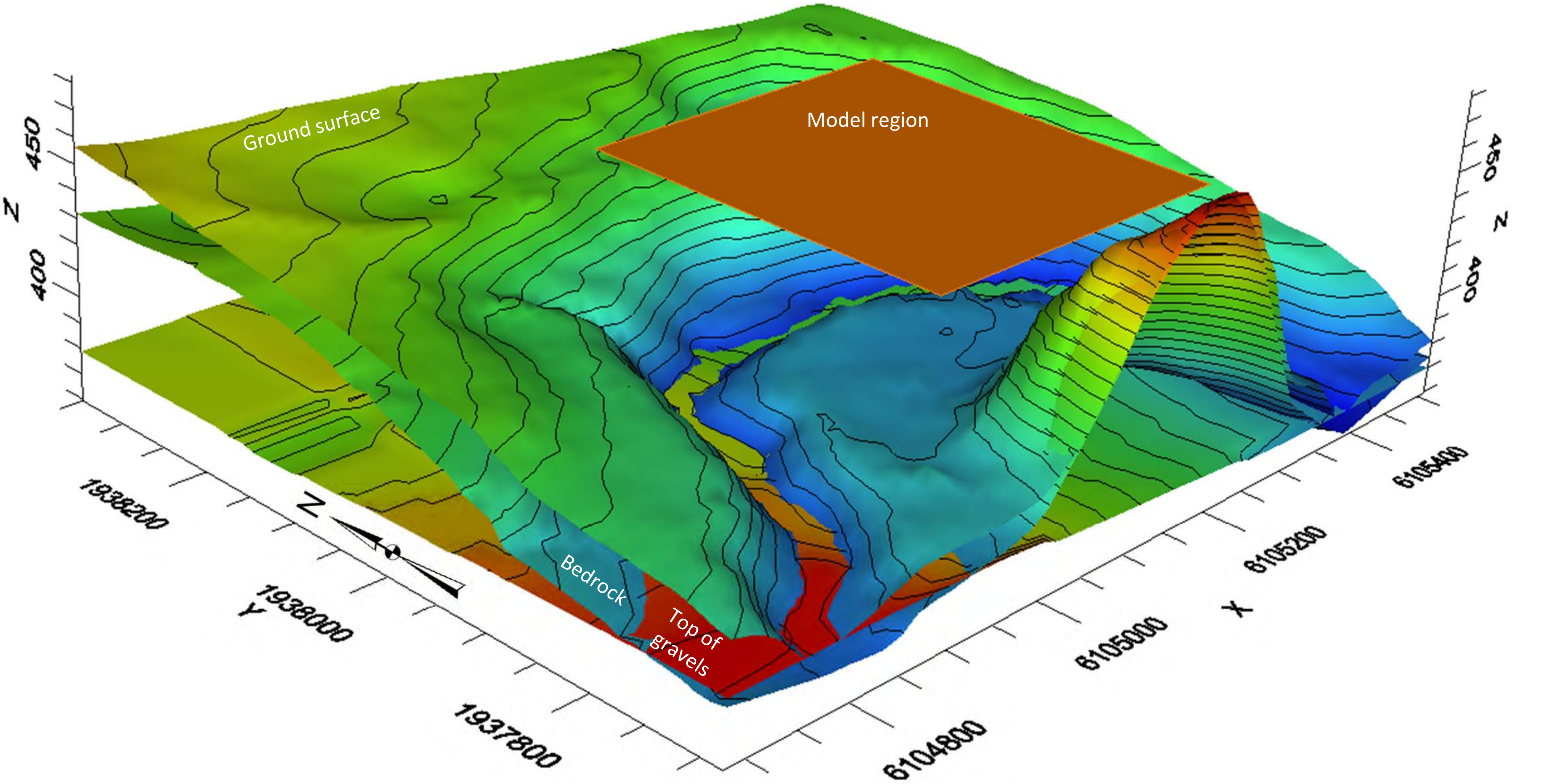
Balance Hydrologics, Inc.®

Figure 10. Distance-drawdown plot after 3,033 minutes of pumping 8.8 gallons per minute during constant-rate pumping test, Parkside Trails, City of Cupertino, California. The slope of the distance-drawdown curve is used to calculate transmissivity (T).



Balance Hydrologics, Inc.®

Figure 11. Location of on-site data sources for groundwater modeling, Parkside Trails, Cupertino, California. Red circles are borings, green squares are test pit locations, blue diamond is pumping well 2014-1, and open diamonds are monitoring wells. Data source: ENGEO geotechnical report, 2013. Coordinates: State Plane Zone III, NAD83.



Balance Hydrologics, Inc.®

Figure 12. Horizons used to construct model domain, Parkside Trails, Cupertino, California. Ground surface was based on the USGS digital elevation model (dem) matched to the site topographic survey. The top of gravel surface was based on ENGEO boring and monitoring logs, Balance Hydrologics pumping-well log, and the location of Stevens Creek, The bedrock surface was similarly based the logs of boring and wells on site, and on an assumed thickness of 10 feet below Stevens Creek. South of Stevens Creek gravel and bedrock elevations were estimated based on conditions found on site.

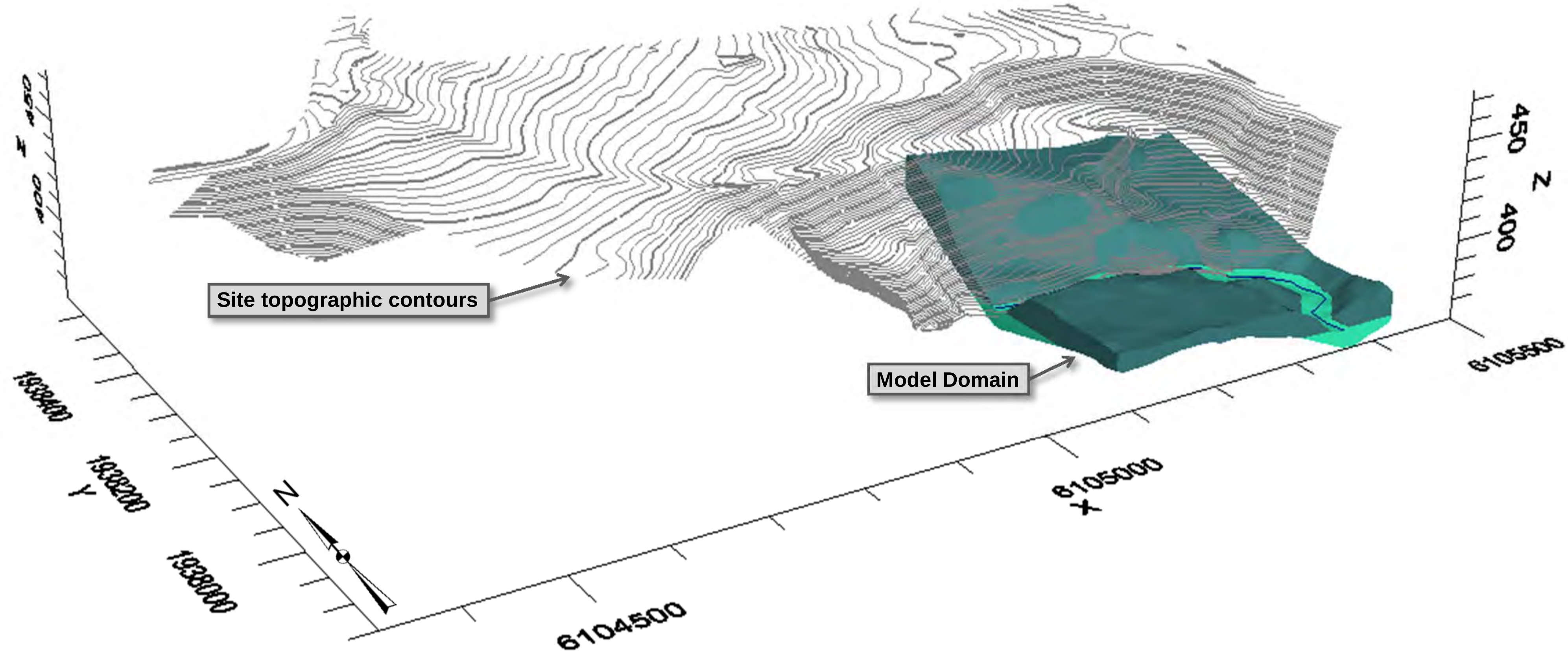
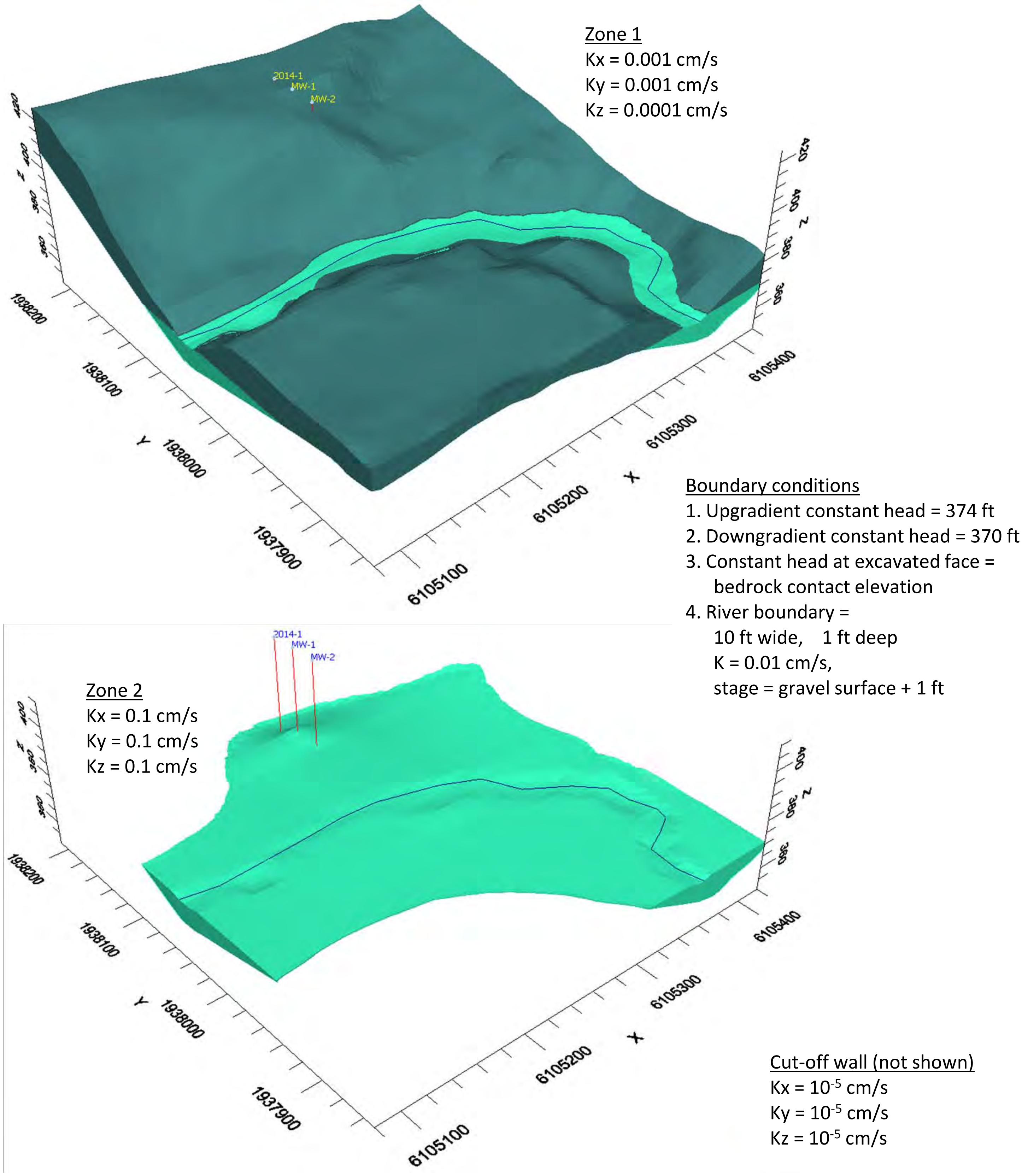


Figure 13. Location of model domain relative to site topography, Parkside Trails, Cupertino, California.



Balance Hydrologics, Inc.®

Figure 14. Groundwater model properties and boundary conditions, Parkside Trails, Cupertino, California. Zone 2 comprises gravel deposits and Zone 1 comprised overlying fine-grain alluvium and fill. Groundwater was found in Zone 2. See Table 7 for complete model summary.

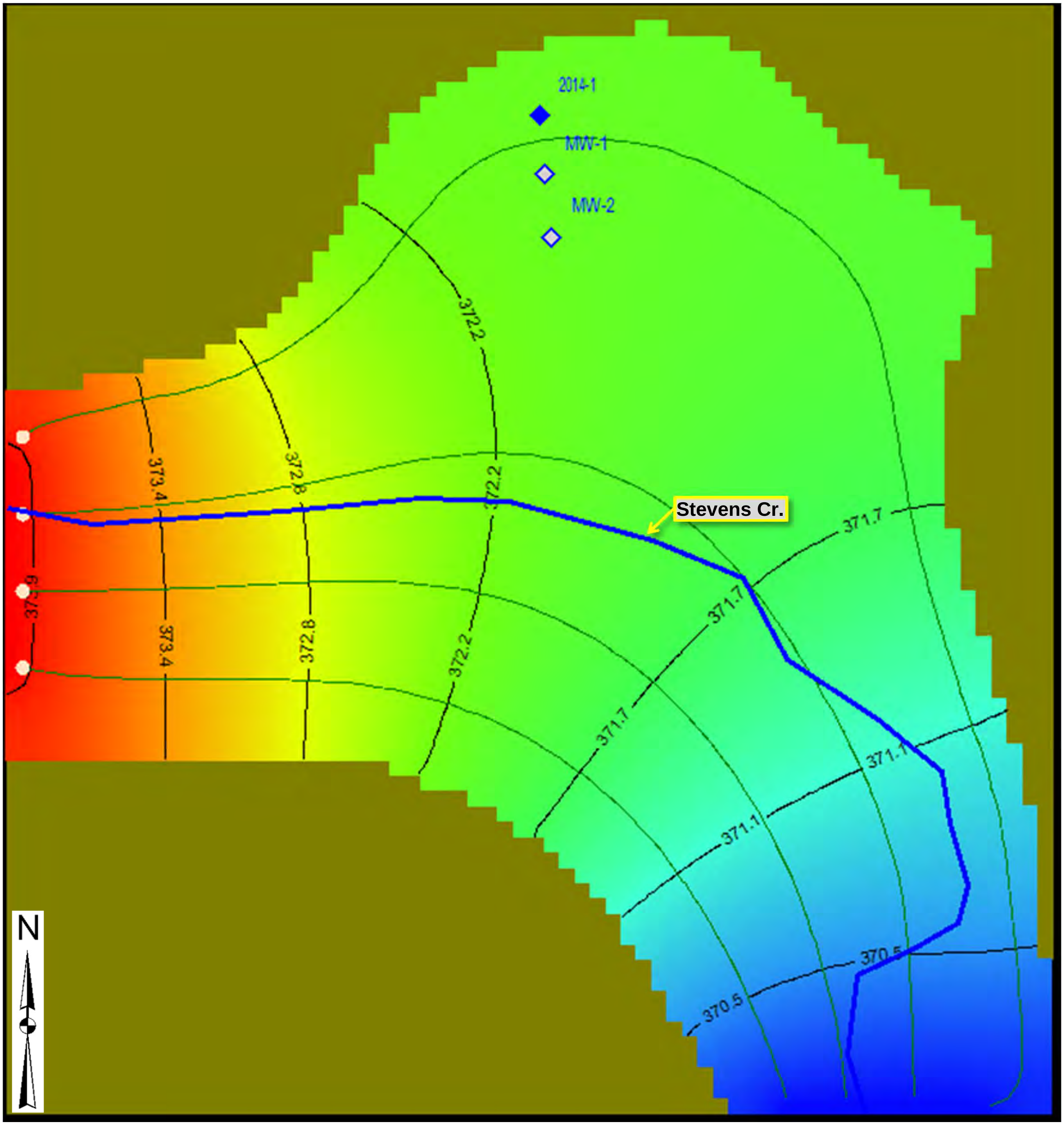


Figure 15. Modeled groundwater contours for existing conditions, Parkside Trails, Cupertino, California. Four particles track through Zone 2, perpendicular to modeled contours and along the flow path of Stevens Creek.
.

Balance Hydrologics, Inc.®

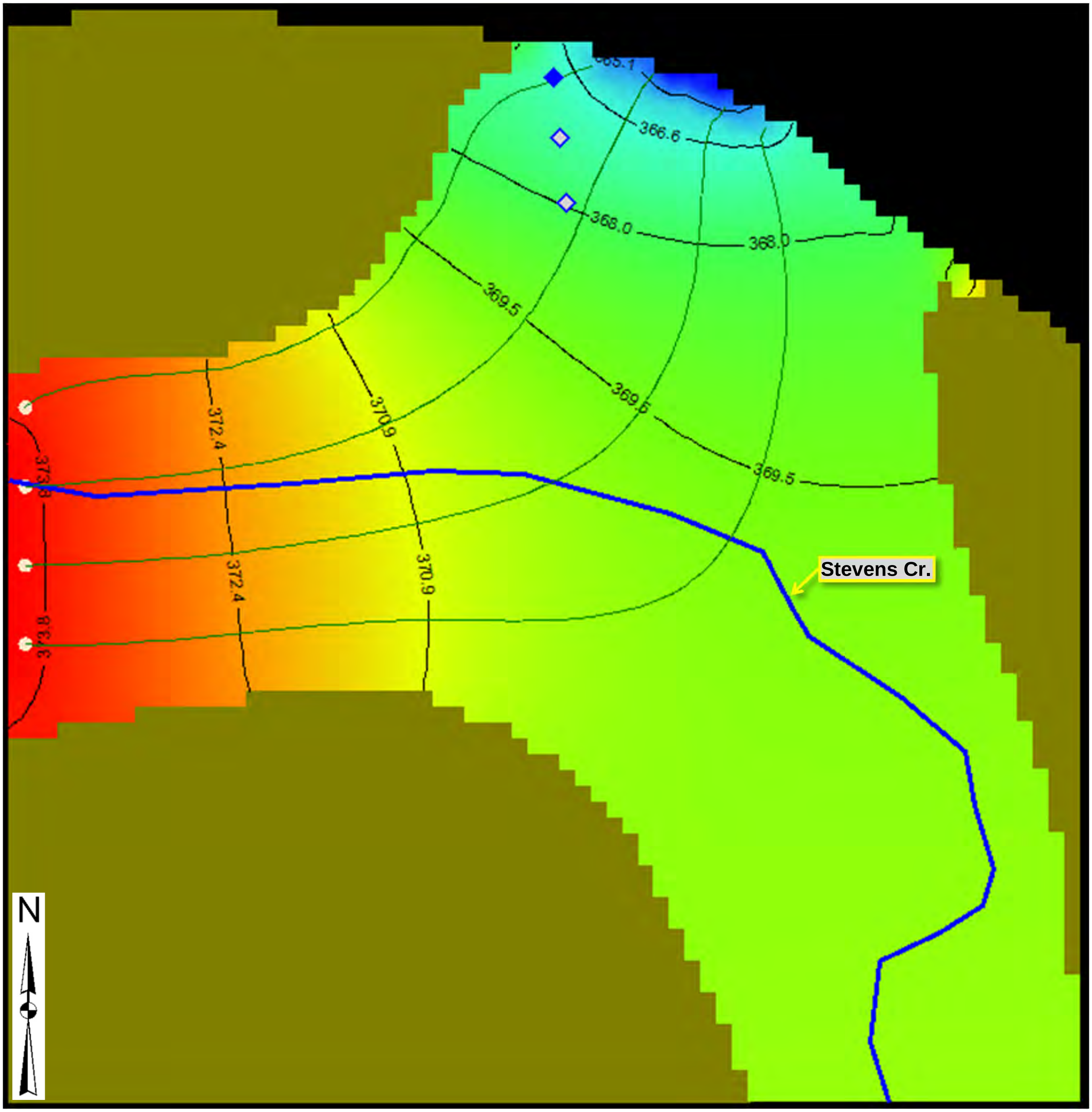


Figure 16. Modeled groundwater contours for excavated conditions without a cut-off wall, Parkside Trails, Cupertino, California. Four particles track through Zone 2, perpendicular to modeled contours and to the excavated area, suggesting a significant impact to flow in the lower portion of Stevens Creek.

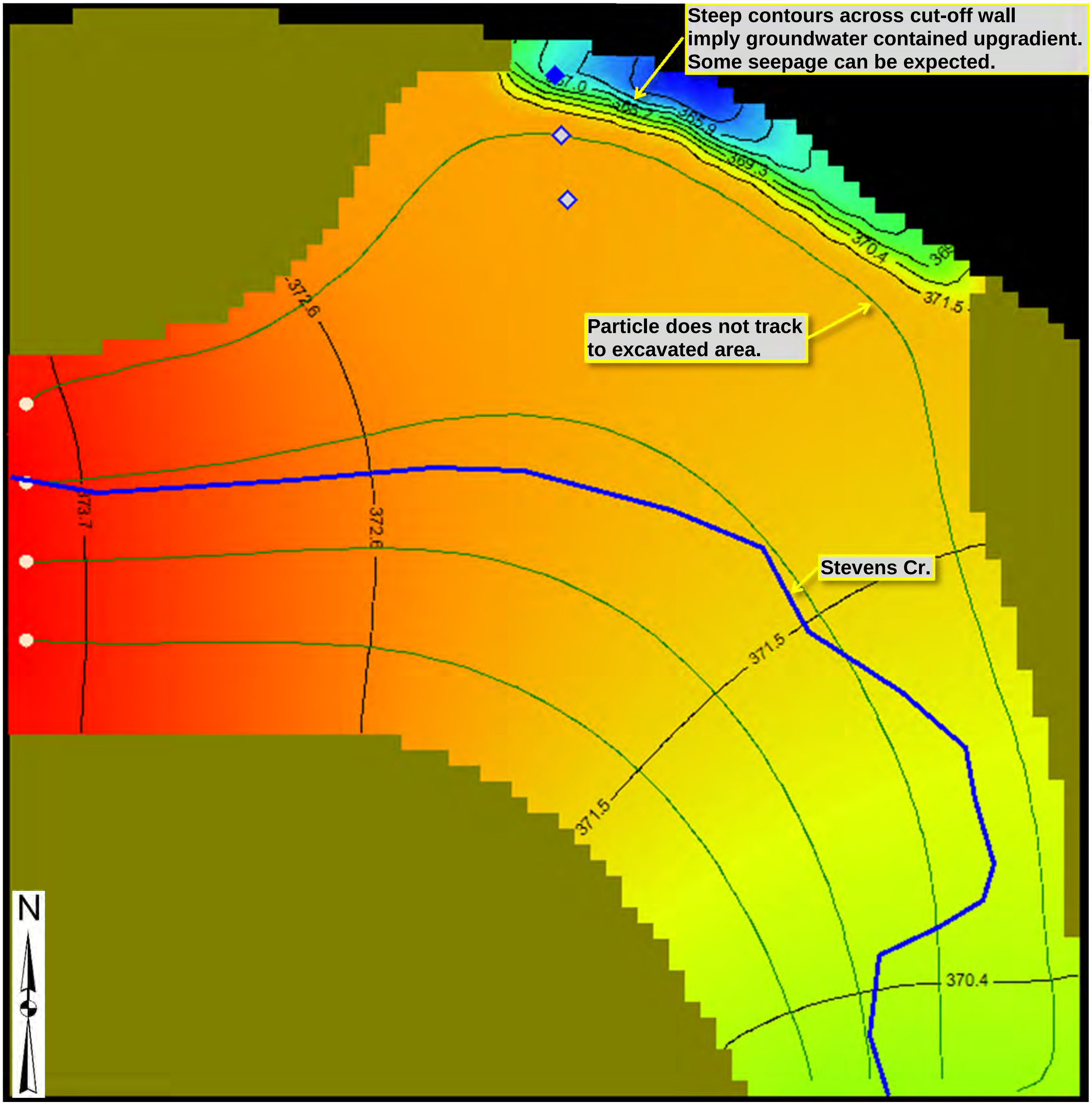


Figure 17. Modeled groundwater contours for excavated conditions that includes a cut-off wall, Parkside Trails, Cupertino, California. As similar to existing conditions, four particles track through Zone 2, along the flow path of Stevens Creek, suggesting no significant effect if properly constructed.

APPENDICES

Appendix A

Well logs

Balance Hydrologics, Inc.

Geologic log for monitoring well 2014-1, APN 351-010-043, Parkside Trails Project, Santa Clara County, California

Property Owner and Mailing Information
Parkside Trails LLC
19357 Zinfendel Ct.
Saratoga, CA 95070

Client:	**Standard Pacific of Northern California**
	3825 Hopyard Rd., Suite 275
	Pleasanton, CA 94588
APN:	**351-010-043**
Site location:	**750 ft. E of Stevens Canyon Rd.**
Latitude, Longitude:	**N 37°18'26.35"; W122° 4'9.85"**
Ground surface elevation:	**412 feet WGS84**

Start drilling date:	**February 18, 2014**
Well completion date:	**February 18, 2014**
Borehole geologist:	**Gustavo Porras**
Drilling company:	**Gregg Drilling**
Driller:	**Jason**
Drilling rig:	**Truck mounted D55**
Driling equipment:	**12-inch hollow-stem auger**
Depth of borehole:	**60 feet**
Depth of casing:	**60 feet**
Diameter of casing:	**6-inch Sch. 40 PVC**

Depth (feet)	Lithology	Sample	Hydrology	Well Construction	Remarks
0–2	SILTY SAND_LBRN: Gray gravelly silty sand, fill				0 to 40 ft.: 6-inch blank Sch. 40 PVC pipe 0 to 36 ft.: cement seal Drilled to 60 feet with 8-inch hollow-stem auger. Then redrilled to same depth with 12-inch hollow-stem auger.
2–23	FILL: Orangish brown gravelly silty sand with some moisture; fill.				
23–42	GRAVELLY CLAY: Gray-green silty gravelly clay; moist.				36 to 38 ft.: Bentonite plug 38 to 60 ft.: backfilled with Lapis #3 sand 40 to 60 ft.: 6-inch screened 0.02 inch slot Sch. 40 PVC pipe
39.5			February 25		
42–50	GRAVEL: Gray-brown subrounded gravels up to 1.5 inches, occasional boulders with some clays, wet		February 18 (43)		42 ft.: Rig chatter during drilling 45 ft.: Rig chatter stops; when well is pumped, water cascades at this depth 48 ft.: Rig chatter during drilling
50–60	SANTA CLARA FORMATION: Dark bluish gray, fine to medium, subrounded, poorly consolidated, well sorted, wet, silty sandstone				Bottom of well has a cap installed

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0199575

Page 1 of 1

Owner's Well Number 2014-1

Date Work Began 2/18/14 Date Work Ended 2/18/14

Local Permit Agency SCVWD

Permit Number 14W00081 Permit Date 2/5/14

DWR Use Only – Do Not Fill In
State Well Number/Site Number
Latitude N Longitude W
APN/TRS/Other

Geologic Log

Orientation ⊗ Vertical ○ Horizontal ○ Angle Specify ______

Drilling Method ______ Drilling Fluid ______

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	1	Silty sand
1	23	Fill: gravelly, silty sand
23	42	gravelly clay
42	50	gravels with some clay
50	60	silty sandstone

Total Depth of Boring 60 Feet

Total Depth of Completed Well 60 Feet

Well Owner

Name Standard Pacific of Northern California

Mailing Address 3825 Hopyard Road, Suite. 275

City Pleasanton State CA Zip 94588

Well Location

Address Stevens Canyon Road

City Cupertino County Santa Clara

Latitude 37 Deg. 18 Min. 26.35 Sec. N Longitude 122 Deg. 4 Min. 9.85 Sec. W

Datum WGS84 Dec. Lat. ______ Dec. Long. ______

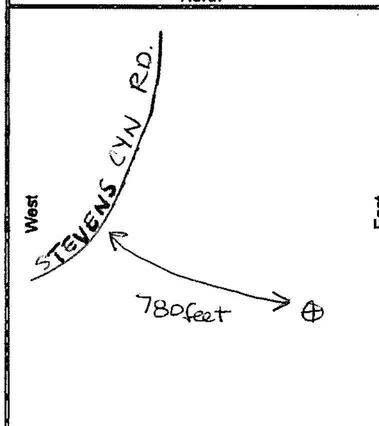
APN Book 351 Page 010 Parcel 043

Township ______ Range ______ Section ______

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North



West East South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

⊗ New Well
○ Modification/Repair
○ Deepen
○ Other ______
○ Destroy (Describe procedures and materials under "GEOLOGIC LOG")

Planned Uses

○ Water Supply
☐ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
⊗ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other ______

Water Level and Yield of Completed Well

Depth to first water 43 (Feet below surface)

Depth to Static Water Level 39 (Feet) Date Measured 2/25/14

Estimated Yield * 8.8 (GPM) Test Type Constant Rate

Test Length 50.5 (Hours) Total Drawdown 4.16 (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	40	6	blank	PVC				
40	60	6	screen	PVC				0.02 inch

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	36	cement	seal
36	38	bentonite	plug
38	60	Lapis #3	sand pack

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other ______

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Gustavo Porras, Balance Hydrologics, Inc.
Person, Firm or Corporation

800 Bancroft Way, Suite 101 Berkeley CA 94710
Address City State Zip

Signed For Gregg Drilling: [signature] 4/2/2014 485165
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

LOG OF BORING MW-1

ENGEO INCORPORATED

Geotechnical Exploration
Parkside Trails
Cupertino, CA
10014.000.100

DATE DRILLED:	2/4/2014	LOGGED / REVIEWED BY:	J. White / JBR
HOLE DEPTH:	46 ft.	DRILLING CONTRACTOR:	Britton Exploration
HOLE DIAMETER:	8.0 in.	DRILLING METHOD:	Hollow Stem Auger
SURF ELEV (NGVD 29):	411 ft.	HAMMER TYPE:	140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx	Well Construction
			SANDY SILT WITH GRAVEL (ML-SM), brown, moist, fine to coarse gravel, fine- to coarse-grained sand (Fill)							2-Inch diameter solid pvc pipe - Annular seal - neat cement grout
	1		SILTY SAND WITH GRAVEL (SM), brown, moist (Fill)							
	2		Increasing gravel content							
10	3									
	4		Increasing clay content							
			CLAYEY SAND WITH GRAVEL (SC), brown, moist, fine- to coarse-grained sand, fine to coarse gravel (Fill)							
	5									
20	6									
	7		SANDY CLAY WITH GRAVEL (CL), very dark gray, moist, fine to coarse gravel and fine- to coarse-grained sand (Fill)							
	8		Increasing sand content							Bentonite
30	9		CLAY WITH SAND (CL), very dark gray, moist, fin- to coarse-grained sand, few rootlets, minor organic odor (Qal)							Well screen and #3 Monterey Sand filter pack
	10									
	11	■	SANDY GRAVEL WITH SILT (GW), dark gray, dense, moist, fine- to coarse-grained sand and gravel (Qal)			28				
40	12									
	13									
	14		Drilling refusal - cobbles							
			Bottom of Boring 46 feet. Groundwater encountered at approximately 35 feet below the ground surface.							

ENGEO INCORPORATED

LOG OF BORING MW-2

Geotechnical Exploration
Parkside Trails
Cupertino, CA
10014.000.100

DATE DRILLED: 1/31/2014
HOLE DEPTH: 46 ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (NGVD 29): 410 ft.

LOGGED / REVIEWED BY: J. White / JBR
DRILLING CONTRACTOR: Britton Exploration
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx	Well Construction
			SILTY SAND WITH GRAVEL (SM), brown, moist, fine- to coarse-grained sand and gravel (Fill)							2-Inch diameter solid pvc pipe. Annular seal - neat cement grout
	1									
	2		SILTY GRAVEL (GM), brown, moist, fine- to coarse-grained sand and gravel (Fill)							
10	3		SILTY SAND WITH GRAVEL (SM), brown, moist fine- to coarse-grained sand and gravel (Fill)							
	4		with clay							
	5		decreasing clay content							
20	6									
	7									
	8		GRAVELLY CLAY (CL), very dark brown, moist, fine to coarse gravel (Fill)							
			decreasing gravel							Bentonite
30	9		SANDY CLAY (CL), dark gray, moist, fine-grained sand (Qal)							Well Screen and #3 Monterey sand filter pack
	10		with fine to coarse gravel							
	11									
40	12		GRAVEL WITH SILT (GW), dark gray, wet, fine to coarse gravel, subangular, some sand, dense (Qal)							
	13	■				65				
	14		SANDSTONE, dark yellowish brown, weak, very closely fractured, moderately weathered, poorly cemented (Santa Clara Formation).							
			Bottom of boring at 46 feet. Groundwater encountered at approximately 35 feet below the ground surface.							

Appendix B

Hydrologic observations

Appendix B. Groundwater monitoring observations, water year 2014, Parkside Trails Project, Santa Clara County, California

Site Conditions			Water Level		Water Quality Observations				Datalogger	Remarks
Time Zone (PST/PDT)	Date/Time (mm/dd/yr hr:mn)	Observer(s) (see notes)	Depth to Water (feet)	Groundwater Elevation (ft amsl)	Water Temperature (°C)	Specific Conductance at field temp. (µmhos/cm)	Specific Conductance at 25C (at 25 °C)	Samples (see nootes)	Datalogger Downloaded? (Y/no)	

MW-1

Reference point elevation (ft NGVD29) = 409.60
Stickup (feet) = -0.40
Ground surface elevation (ft NGVD29) = 410.00
Depth of well from ground surface (feet) = 41.90
Depth to levelogger from RP (feet) = 41.50

Time Zone	Date/Time	Observer(s)	Depth to Water	Groundwater Elevation	Water Temperature	Specific Conductance at field temp.	Specific Conductance at 25C	Samples	Datalogger Downloaded?	Remarks
PST	2/11/14 10:14	gp	39.00	370.60	15.3	1445	1774	no	no	Installed levelogger F15; sn 10 104 4511; Bal#: 2159; recording hourly; installed 11:07
PST	2/18/14 10:40	gp	38.60	371.00	---	---		no	no	
PST	2/21/14 8:18	gp	38.58	371.02	15.1	1656	2041	no	no	Well 2014-1 development day
PST	2/21/14 14:57	gp	38.65	370.95	---	---		no	no	
PST	2/25/14 14:10	gp	38.58	371.02	15.4	1513	1848	no	yes	
PDT	3/17/14 9:05	gp	38.62	370.98	---	---		no	yes	
PDT	3/17/14 12:50	gp	38.61	370.99				no	no	
PDT	3/18/14 11:29	gp	38.62	370.98				no	no	
PDT	3/18/14 15:44	gp	38.71	370.89				no	no	
PDT	3/19/14 10:08	gp	38.68	370.92				no	no	Pumping begins at well 2014-1
PDT	3/19/14 12:21	gp	38.73	370.87				no	no	
PDT	3/20/14 10:42	gp	38.95	370.65				no	no	Pumping well 2014-1 continues
PDT	3/20/14 13:16	gp	39.97	369.63				no	no	
PDT	3/21/14 12:41	gp	39.02	370.58				no	no	Pumping well 2014-1 ends; recovery begins
PDT	3/21/14 14:21	gp	39.02	370.58				no	no	
PDT	3/24/14 13:59	gp	38.65	370.95	15.2	1377	1686	no	yes	Recovery ends; demob instruments

MW-2

Reference point elevation (ft NGVD29) = 408.55
Stickup (feet) = -0.40
Ground surface elevation (ft NGVD29) = 408.95
Depth of well from ground surface (feet) = 44.90
Depth to levelogger from RP (feet) = 44.50

Time Zone	Date/Time	Observer(s)	Depth to Water	Groundwater Elevation	Water Temperature	Specific Conductance at field temp.	Specific Conductance at 25C	Samples	Datalogger Downloaded?	Remarks
PST	2/11/14 10:16	gp	37.68	370.87	15.0	878	1086	no	no	Installed levelogger F15; sn 62218; Bal#: n/a; recording hourly; installed 11:50
PST	2/18/14 10:43	gp	37.55	371.00	---	---		no	no	

Site Conditions			Water Level		Water Quality Observations				Datalogger	Remarks
Time Zone (PST/PDT)	Date/Time (mm/dd/yr hr:mn)	Observer(s) (see notes)	Depth to Water (feet)	Groundwater Elevation (ft amsl)	Water Temperature (°C)	Specific Conductance at field temp. (µmhos/cm)	Specific Conductance at 25C (at 25 °C)	Samples (see nootes)	Datalogger Downloaded? (Y/no)	
PST	2/21/14 8:28	gp	37.60	370.95	14.6	856	1067	no	no	Well 2014-1 development day
PST	2/21/14 15:00	gp	37.58	370.97	---	---		no	no	
PST	2/25/14 14:02	gp	37.51	371.04	15.1	885	1089	no	yes	
PDT	3/17/14 9:09	gp	37.53	371.02	---	---		no	yes	
PDT	3/17/14 12:52	gp	37.52	371.03	---	---		no	no	
PDT	3/18/14 11:25	gp	37.54	371.01	---	---		no	no	
PDT	3/18/14 15:41	gp	37.60	370.95	---	---		no	no	
PDT	3/19/14 10:06	gp	37.58	370.97	---	---		no	no	Pumping begins at well 2014-1
PDT	3/19/14 12:23	gp	37.61	370.94	---	---		no	no	
PDT	3/20/14 10:43	gp	37.80	370.75	---	---		no	no	Pumping well 2014-1 continues
PDT	3/20/14 13:17	gp	37.80	370.75	---	---		no	no	
PDT	3/21/14 12:40	gp	37.84	370.71	---	---		no	no	Pumping well 2014-1 ends; recovery begins
PDT	3/21/14 14:24	gp	37.82	370.73	---	---		no	no	
PDT	3/24/14 13:45	gp	37.58	370.97	14.5	911	1140	no	yes	Recovery ends; demob instruments

Site Conditions			Water Level		Water Quality Observations				Datalogger	Remarks
Time Zone (PST/PDT)	Date/Time (mm/dd/yr hr:mn)	Observer(s) (see notes)	Depth to Water (feet)	Groundwater Elevation (ft amsl)	Water Temperature (°C)	Specific Conductance at field temp. (µmhos/cm)	Specific Conductance at 25C (at 25 °C)	Samples (see nootes)	Datalogger Downloaded? (Y/no)	
Well 2014-1										
Reference point elevation (ft NGVD29) =			413.22							
Stickup (feet) =			2.66							
Ground surface elevation (ft NGVD29) =			410.56							
Depth of well from ground surface (feet) =			60.00							
PST	2/18/14 15:41	gp	35.71	377.51	21.2	566	612	no	no	Well drilled today; no levelogger installed.
PST	2/21/14 8:18	gp	41.03	372.19	16.2	571	693	yes	no	Well developed today: bail, surge with surge block, bail; pump. Water quality samples taken 13:00-13:30
PST	2/25/14 14:36	gp	42.23	370.99	15.8	649	780	yes	yes	Re-sampled well for GenMin and for Acrylonitrile
PDT	3/17/14 8:55	gp	42.24	370.98	15.4	661	809	no	yes	Pump installation day
PDT	3/17/14 10:35	gp	42.24	370.98						After pump, sounding tube and Levelogger are in place
PDT	3/18/14 11:31	gp	42.25	370.97	15.4	662	810	no	no	Setting flow rate
PDT	3/18/14 13:23	gp	---		15.4	660	810	yes	no	After meter calibration, turbidity = 0.55 NTUs; water looks clear, not reaching Stevens Creek
PDT	3/19/14 10:15	gp	42.29	370.93				no	no	Pumping begins
PDT	3/19/14 12:00	gp	---		15.9	664	810	yes	no	After meter calibration, turbidity = 0.27 NTUs; water looks clear, not reaching Stevens Creek
PDT	3/19/14 12:15	gp	45.80	367.42				no	no	
PDT	3/20/14 10:30	gp	46.30	366.92	15.2	644	792	no	no	Pumping well 2014-1 continues
PDT	3/20/14 11:45	gp	---		16.9	681	805	yes	no	After meter calibration, turbidity = 0.01 NTUs; water looks clear, not reaching Stevens Creek
PDT	3/20/14 13:10	gp	46.25	366.97				no	no	
PDT	3/21/14 12:45	gp	46.45	366.77				no	no	
PDT	3/21/14 12:50	gp	---		16.5	661	789	yes	no	After meter calibration, turbidity = 0.03 NTUs; water looks clear, not reaching Stevens Creek
PDT	3/21/14 13:45	gp	46.45	366.77				no	no	Pumping well 2014-1 stops; recovery begins
PDT	3/21/14 14:20	gp	42.61	370.61				no	no	
PDT	3/24/14 14:10	gp	42.30	370.92	15.3	647	794	no	yes	Recovery ends; demob instruments
Stevens Creek										
PST	2/11/14 12:30	gp	---	---	11.8	630	843	no	no	No Balance staff plate, no levelogger
PST	2/21/14 13:40	gp	---	---	12.4	587	775	yes	no	Water quality samples taken 13:45
PST	2/25/14 15:25	gp	---	---	13.0	667	866	yes	no	Re-sampled Stevens Creek for GenMin

Site Conditions			Water Level		Water Quality Observations				Datalogger	Remarks
Time Zone (PST/PDT)	Date/Time (mm/dd/yr hr:mn)	Observer(s) (see notes)	Depth to Water (feet)	Groundwater Elevation (ft amsl)	Water Temperature (°C)	Specific Conductance at field temp. (µmhos/cm)	Specific Conductance at 25C (at 25 °C)	Samples (see nootes)	Datalogger Downloaded? (Y/no)	
PDT	3/18/14 13:23	gp			12.9	603	784	yes	no	After meter calibration, turbidity = 7.19 NTUs; water is discharged to terrace where there is no ponding; water percolates into ground, does not reach creek
PDT	3/19/14 12:00	gp			11.2	545	740	yes	no	After meter calibration, turbidity = 8.33 NTUs; small ponded area around discharge bucket; water percolates into ground, does not reach creek;
PDT	3/20/14 11:45	gp			14.3	631	793	yes	no	After meter calibration, turbidity = 12.11 NTUs; water is discharged to terrace where there is no ponding; water percolates into ground, does not reach creek
PDT	3/21/14 12:50	gp			15.0	635	785	yes	no	After meter calibration, turbidity = 10.73 NTUs; water is discharged to terrace where there is no ponding; water percolates into ground, does not reach creek

Notes:

1) mw is Mark Woyshner, gp is Gustavo Porras

2) NR is not recorded

3) NA or "-" is not applicable

4) Abbreviations: SCT = specific conductance and temperature; DL = datalogger; PT = pressure transducer; HWM = high water mark

5) Barologger info: Levelogger F15; Set to elevation 410 ft.; SN 2-1026935; Bal#: 1867; Started 1/30/14 14:00 PST

Appendix C

Analytical laboratory report

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Balance Hydrologics Inc.
800 Bancroft Way, Suite 101
Berkeley, CA 94710-2227
Attn: Gustavo Porras

Work Order #: 4020586
Reporting Date: March 3, 2014

Date Received:	February 24, 2014
Project # / Name:	None / 213200
Water System #:	NA
Sample Identification:	213200 Stevens Creek Gen. Min. 140221 1345, sampled 2/21/2014 1:45:00PM
Sampler Name / Co.:	Gustavo Porras / Balance Hydrologics
Matrix:	Water
Laboratory #:	4020586-01

	Results	Units	RL	State Drinking Water Limits 1	Analysis Method	Date Analyzed	Flags
General Mineral							
pH	7.9	pH Units	0.1	-	SM4500-H+ B	02/24/14	
Specific Conductance (EC)	830	uS/cm	1.0	1600	SM2510B	02/24/14	
Hydroxide as OH	ND	mg/L	2.0	-	SM 2320B	02/24/14	
Carbonate as CO3	ND	mg/L	2.0	-	SM 2320B	02/24/14	
Bicarbonate as HCO3	450	mg/L	2.0	-	SM 2320B	02/24/14	
Total Alkalinity as CaCO3	370	mg/L	2.0	-	SM 2320B	02/24/14	
Hardness	410	mg/L	5.0	-	SM 2340 B	02/26/14	
Total Dissolved Solids	480	mg/L	10	1000	SM2540C	02/24/14	
Nitrate as NO3	ND	mg/L	1.0	45	EPA 300.0	02/26/14	
Chloride	32	mg/L	1.0	500	EPA 300.0	02/26/14	
Sulfate as SO4	59	mg/L	1.0	500	EPA 300.0	02/26/14	
Fluoride	0.17	mg/L	0.10	2	EPA 300.0	02/26/14	
Calcium	97	mg/L	0.50	-	EPA 200.7	02/26/14	
Magnesium	39	mg/L	0.50	-	EPA 200.7	02/26/14	
Potassium	2.3	mg/L	0.50	-	EPA 200.7	02/26/14	
Sodium	30	mg/L	0.50	-	EPA 200.7	02/26/14	
Iron	ND	ug/L	50	300	EPA 200.7	02/26/14	
Manganese	ND	ug/L	20	50	EPA 200.7	02/26/14	
Copper	ND	ug/L	50	1000	EPA 200.7	02/26/14	
Zinc	ND	ug/L	50	5000	EPA 200.7	02/26/14	
Inorganics							
Nitrate+Nitrite as N	0.13	mg/L	0.10	10	EPA 300.0	02/26/14	
Arsenic	2.3	ug/L	2.0	10	EPA 200.8	02/25/14	
Barium	180	ug/L	100	1000	EPA 200.7	02/26/14	

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.
State Drinking Water Limits1 - as listed by California Administrative Code, Title 22.
* - a * in the left hand margin of the report means that particular constituent is above the California Drinking Water Limits.

Mike Galloway

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Balance Hydrologics Inc.
800 Bancroft Way, Suite 101
Berkeley, CA 94710-2227
Attn: Gustavo Porras

Work Order #: 4020586
Reporting Date: March 3, 2014

Date Received:	February 24, 2014
Project # / Name:	None / 213200
Water System #:	NA
Sample Identification:	213200 Stevens Creek Gen. Min. 140221 1345, sampled 2/21/2014 1:45:00PM
Sampler Name / Co.:	Gustavo Porras / Balance Hydrologics
Matrix:	Water
Laboratory #:	4020586-01

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Inorganics							
Boron	320	ug/L	100	-	EPA 200.7	02/26/14	
Cadmium	ND	ug/L	1.0	5	EPA 200.8	02/25/14	
Chromium	ND	ug/L	1.0	50	EPA 200.8	02/25/14	
Cyanide (total)	ND	ug/L	100	200	SM 4500-CN F	03/03/14	
Lead	ND	ug/L	5.0	15	EPA 200.8	02/25/14	
Mercury	ND	ug/L	1.0	2	EPA 245.1	02/27/14	
Selenium	ND	ug/L	5.0	50	EPA 200.8	02/25/14	
Silver	ND	ug/L	10	100	EPA 200.8	02/25/14	
MBAS (Surfactants)	ND	mg/L	0.025	0.5	SM5540C	02/26/14	
Aluminum	ND	ug/L	50	1000	EPA 200.7	02/26/14	
Antimony	ND	ug/L	6.0	6	EPA 200.8	02/25/14	
Beryllium	ND	ug/L	1.0	4	EPA 200.7	02/26/14	
Nickel	ND	ug/L	10	100	EPA 200.7	02/26/14	
Thallium	ND	ug/L	1.0	2	EPA 200.8	02/25/14	
Nitrite as N	ND	mg/L	0.10	1	EPA 300.0	02/26/14	
General Physical							
Color	ND	Color Units	3.0	-	SM 2120B	02/24/14	
Threshold Odor No.	ND	T.O.N.	1.0	-	SM 2150B	02/24/14	
Turbidity	ND	NTU	0.10	-	SM 2130B	02/24/14	

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.
State Drinking Water Limits[1] - as listed by California Administrative Code, Title 22.
* - a * in the left hand margin of the report means that particular constituent is above the California Drinking Water Limits.

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Balance Hydrologics Inc.
800 Bancroft Way, Suite 101
Berkeley, CA 94710-2227
Attn: Gustavo Porras

Work Order #: 4020586
Reporting Date: March 3, 2014

Date Received:	February 24, 2014
Project # / Name:	None / 213200
Water System #:	NA
Sample Identification:	213200 2014-1 Gen. Minerals 140221 1330, sampled 2/21/2014 1:30:00PM
Sampler Name / Co.:	Gustavo Porras / Balance Hydrologics
Matrix:	Water
Laboratory #:	4020586-02

	Results	Units	RL	State Drinking Water Limits 1	Analysis Method	Date Analyzed	Flags
General Mineral							
pH	7.1	pH Units	0.1	-	SM4500-H+ B	02/24/14	
Specific Conductance (EC)	750	uS/cm	1.0	1600	SM2510B	02/24/14	
Hydroxide as OH	ND	mg/L	2.0	-	SM 2320B	02/24/14	
Carbonate as CO3	ND	mg/L	2.0	-	SM 2320B	02/24/14	
Bicarbonate as HCO3	390	mg/L	2.0	-	SM 2320B	02/24/14	
Total Alkalinity as CaCO3	320	mg/L	2.0	-	SM 2320B	02/24/14	
Hardness	350	mg/L	5.0	-	SM 2340 B	02/26/14	
Total Dissolved Solids	430	mg/L	10	1000	SM2540C	02/24/14	
Nitrate as NO3	ND	mg/L	1.0	45	EPA 300.0	02/26/14	
Chloride	31	mg/L	1.0	500	EPA 300.0	02/26/14	
Sulfate as SO4	52	mg/L	1.0	500	EPA 300.0	02/26/14	
Fluoride	0.17	mg/L	0.10	2	EPA 300.0	02/26/14	
Calcium	87	mg/L	0.50	-	EPA 200.7	02/26/14	
Magnesium	33	mg/L	0.50	-	EPA 200.7	02/26/14	
Potassium	1.9	mg/L	0.50	-	EPA 200.7	02/26/14	
Sodium	29	mg/L	0.50	-	EPA 200.7	02/26/14	
* Iron	960	ug/L	50	300	EPA 200.7	02/26/14	
* Manganese	510	ug/L	20	50	EPA 200.7	02/26/14	
Copper	ND	ug/L	50	1000	EPA 200.7	02/26/14	
Zinc	ND	ug/L	50	5000	EPA 200.7	02/26/14	
Inorganics							
Nitrate+Nitrite as N	ND	mg/L	0.10	10	EPA 300.0	02/26/14	
Arsenic	ND	ug/L	2.0	10	EPA 200.8	02/25/14	
Barium	200	ug/L	100	1000	EPA 200.7	02/26/14	

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.
State Drinking Water Limits1 - as listed by California Administrative Code, Title 22.
* - a * in the left hand margin of the report means that particular constituent is above the California Drinking Water Limits.

Mike Galloway

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Balance Hydrologics Inc.
800 Bancroft Way, Suite 101
Berkeley, CA 94710-2227
Attn: Gustavo Porras

Work Order #: 4020586
Reporting Date: March 3, 2014

Date Received:	February 24, 2014
Project # / Name:	None / 213200
Water System #:	NA
Sample Identification:	213200 2014-1 Gen. Minerals 140221 1330, sampled 2/21/2014 1:30:00PM
Sampler Name / Co.:	Gustavo Porras / Balance Hydrologics
Matrix:	Water
Laboratory #:	4020586-02

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Inorganics							
Boron	200	ug/L	100	-	EPA 200.7	02/26/14	
Cadmium	ND	ug/L	1.0	5	EPA 200.8	02/25/14	
Chromium	3.2	ug/L	1.0	50	EPA 200.8	02/25/14	
Cyanide (total)	ND	ug/L	100	200	SM 4500-CN F	03/03/14	
Lead	ND	ug/L	5.0	15	EPA 200.8	02/25/14	
Mercury	ND	ug/L	1.0	2	EPA 245.1	02/27/14	
Selenium	ND	ug/L	5.0	50	EPA 200.8	02/25/14	
Silver	ND	ug/L	10	100	EPA 200.8	02/25/14	
MBAS (Surfactants)	ND	mg/L	0.025	0.5	SM5540C	02/26/14	
Aluminum	670	ug/L	50	1000	EPA 200.7	02/26/14	
Antimony	ND	ug/L	6.0	6	EPA 200.8	02/25/14	
Beryllium	ND	ug/L	1.0	4	EPA 200.7	02/26/14	
Nickel	ND	ug/L	10	100	EPA 200.7	02/26/14	
Thallium	ND	ug/L	1.0	2	EPA 200.8	02/25/14	
Nitrite as N	ND	mg/L	0.10	1	EPA 300.0	02/26/14	
General Physical							
Color	ND	Color Units	3.0	-	SM 2120B	02/24/14	
Threshold Odor No.	ND	T.O.N.	1.0	-	SM 2150B	02/24/14	
Turbidity	ND	NTU	0.10	-	SM 2130B	02/24/14	

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.
State Drinking Water Limits[1] - as listed by California Administrative Code, Title 22.
* - a * in the left hand margin of the report means that particular constituent is above the California Drinking Water Limits.

Mike Galloway